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SYDNEY.

## Transactions of the Australasian Medical Congress (British Medical Association)

Second Session: Dunedin, February 3 to 10, 1927



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## A SELECTION OF CASES FROM AMONG NAVAL PATIENTS OF INTEREST FROM A BACTERIOLOGICAL POINT OF VIEW.

By W. E. J. PARADICE, M.B., Ch.M.,  
Surgeon Lieutenant-Commander, Royal Australian Navy,  
Microbiological Laboratory, Garden Island.  
(Continued from page 128.)

### Summary.

Three types of infection of the tonsils by the organisms of Vincent's angina are met with:

1. The pure infection.—The ulcer is almost white, very hard and friable and there is only slight constitutional disturbance. Microscopically spirochaetes and fusiform bacilli are present in pure culture.

2. Mixed infection, with Vincent's organisms predominating.—The ulcer is whitish, hard and friable and there is much constitutional disturbance. Microscopically spirochaetes and fusiform bacilli in large numbers are seen, accompanied by various other organisms.

The worst case of this type that I have met, was one in which a large diphtheroid was present.

3. Mixed infection, Vincent's organisms being present in small numbers only.—The ulcer is yellowish, soft and exuding pus. The constitutional disturbance is variable. Microscopically a few spirochaetes and fusiform bacilli are seen among large numbers of other organisms.

All types yield to *liquor arsenicalis* and perchloride of mercury. Type 3 responds to any of the paints usually used in the treatment of tonsillitis, but types 1 and 2 do not.

In the mixed cases it is possible to get the combined infection of diphtheria and Vincent's angina. Such cases are, of course, treated primarily as diphtheria. I have met with one such case.

"Novarsenobillon" given intravenously or applied locally has been recommended, but in view of the fact that a patient who was receiving a course of this drug developed Vincent's angina after his third injection, I did not experiment further with it.

### Cystitis of Unusual Aetiology.

CASE I.—The patient complained of abdominal pain and diarrhoea, stating that he had been constipated for several days and that he had taken a dose of "Beecham's Pills" on the previous day.

Previous illnesses.—He had had uncomplicated gonorrhoea of short duration four years ago, but no other illness of importance.

Physical examination.—No abnormality was detected.

Treatment was prescribed for the diarrhoea.

Next day the patient reported with pain in the lumbar region, the diarrhoea having now stopped.

A urine specimen was obtained and examined. A faint cloud of albumin was present and centrifugalization yielded a sediment containing pus cells and large numbers of organisms having the following characters. They were about one and a half times the diameter of the ordinary *Staphylococcus albus*. They were arranged in pairs, with the opposing surfaces flattened or even concave. They were found to be Gram-positive. Grown on nutrient agar at the end of twenty-four hours the culture was similar to a culture of ordinary *Staphylococcus albus*, but a film from it showed the organisms to be arranged in pairs and still of greater diameter than typical *Staphylococcus albus*. A subculture incubated for a further twenty-four hours yielded organisms which were larger than typical *Staphylococcus albus*, but were smaller than those obtained from the urine or from the first culture; they had lost their diplococcal grouping, being typically staphylococcal.

The condition was treated for five days with potassium citrate, at the end of which time the urine was sterile.

There was no elevation of pulse or temperature at any time.

CASE II.—The patient complained of pain on micturition for three days, a small urethral discharge, blood in his urine at end of micturition and pain in his loin and hypogastrium.

Previous illness.—He had had no previous illness of importance.

Physical examination.—His temperature was 37.5° C. (99.5° F.) and his pulse rate 94. There was tenderness to pressure over the hypogastrium. His urine contained a trace of bile; the centrifugized deposit yielded blood, pus and organisms similar in appearance to those in the first case, which behaved in a similar manner when cultured.

The patient was treated with potassium citrate for nine days, at the end of which time the urine was sterile.

Bile was not demonstrated in the urine after the first day and the temperature was normal from the third day onwards.

### Résumé.

These cases are recorded as they appear to show that either *Staphylococcus albus* can assume an abnormal form when grown comparatively anaerobically in the presence of urinary (and perhaps other organic) constituents or that there is a particular variety of this coccus which behaves in the manner described under given circumstances.

On two other occasions I have met with organisms similar in appearance and staining reaction to those described in serous exudate from indolent sores caused by cuts on rocks (probably covered by shells) under salt water.

I did not have an opportunity to culture the organisms on these occasions.

### Secondary Cystitis.

CASE I.—History.—The patient complained of excruciating pain during micturition, especially at the end, when pure blood was passed *per urethram*. When passing urine

on the previous evening, he noticed that it was very cloudy and that a foul-smelling gas was passed *per urethram* with the urine.

Next morning the symptoms described above were present.

Previous illnesses.—He had had no illnesses of any severity and no trouble whatever in connexion with genito-urinary system.

For the previous five years, however, dating from an ordinary attack of influenza, he had from time to time suffered from abdominal discomfort, most noticeable in the right iliac fossa and accompanied by slight tenderness to pressure, but not by reflex rigidity.

Physical examination.—There was slight tenderness to pressure over the right iliac fossa and in the bladder region. The temperature was 39° C. (102.2° F.) and the pulse rate 115. No other abnormality was discovered.

There was a typical bacilluria; the urine contained a very heavy cloud of albumin; blood and pus were present.

The bacilli were coliform organisms and were present in pure culture.

The patient was treated with "Hexamine" and at the end of a week the urine was clear and the temperature normal.

The patient was allowed up, but that evening pain on micturition returned and the temperature rose to 38.8° C. (102° F.). Coliform bacilli again appeared in the urine. During the next week the temperature rose at times to 39.4° C. (103° F.) and the patient suffered from a severe headache. A profuse urethral discharge was present for some days. Treatment with "Hexamine" was continued, the bacilli lost their motility and gradually disappeared, the temperature taking about three weeks to subside to normal.

CASE II.—The patient complained of severe abdominal pain, accompanied by vomiting. He had suffered from intermittent abdominal discomfort for some weeks before.

He had had no previous illnesses of any severity.

A subacute appendicitis was diagnosed and operation was performed on the next day. A slightly inflamed appendix was found and removed.

The next day patient complained of pain on micturition and passed blood *per urethram*. The urine was found to contain coliform bacilli. A cystoscopic examination revealed nothing beyond the signs of acute cystitis.

The patient was treated with "Hexamine" and made an uninterrupted recovery.

It is worthy of note that these two cases occurred in officers (both medical officers) who had been cruising in Queensland waters about four months previously. The water supply of some Queensland ports is very inferior and the possibility of an infection with a coliform organism from it must be borne in mind.

Personally I do not think that this was the case and, if so, the incubation period would be an extremely long one, namely, four months.

COLONEL J. S. PURDY (Sydney) referred to an outbreak of tonsillitis on the S.S. *Shropshire*, a transport with the expeditionary force. The time honoured custom, dating from Nelson's day, of swabbing decks was carried out on this ship. Through his representations it was discontinued and the outbreak ceased apparently because of the decks being allowed to dry. Recently in reading Captain Cook's journal he had found that on the *Discovery* Captain Cook had noticed outbreaks of tonsillitis and had introduced the practice of lighting cauldrons to dry the decks after swabbing. Unlike Cook's recommendations regarding scurvy, the suggestion in regard to swabbing had not been adopted by the Admiralty.

LIEUTENANT-COLONEL A. R. D. CARBERRY (Wellington) mentioned that a similar condition prevailed at Codford Camp until wet swabbing was abolished.

## SECTION XI.—ORTHOPÆDICS.

### MUSCLE TONE.

By N. D. ROYLE, M.D. (Sydney),  
Honorary Orthopædic Surgeon, Lewisham Hospital,  
Sydney; Honorary Orthopædic Surgeon,  
State Children's Relief  
Board.

#### Muscle Tone from a Clinical Point of View.

A DEFINITION of muscle tonus in a normal conscious subject is very difficult to give. Most of our ideas of muscle tonus have been derived from abnormal preparations such as Sherrington's decerebrate animal or the spinal animal which dominated the physiologist's viewpoint before Sherrington's time.

An examination of a few definitions will serve to place before you the present state of our knowledge of muscle tonus. I suppose that the most prevalent idea regarding muscle tone is voiced by Starling's definition.<sup>(1)</sup> This is as follows:

Every muscle in the body is in a condition of slightly continued contraction that keeps it tense so that when it contracts in response to a stimulus, there is, so to speak, no "slack" to be taken up before the muscle begins to pull on its attachment. This tone is seen in the retraction undergone by muscles or tendons when they are divided in the living animal.

The inadequacy of such a definition can easily be demonstrated by a clinical examination of the ordinary individual. For example, there is slack in the patellar tendon even when the knee is bent to a right angle. This is demonstrated by noting the manner in which the patellar tendon tightens as a preliminary to moving the leg. In addition, there is a definite time interval between the innervation of the muscle and the extension of the leg. When the knee is fully extended the amount of slack is great enough to allow considerable excursion of the patellar in lateral and medial directions.

The second part of the definition is equally fallacious, in that it is not in keeping with physiological or clinical observation. Not only is there no retraction in the normal muscle when the muscle is at rest, but even in a decerebrate preparation section of the *tendo Achillis* in actual experiment did not lead to separation of the divided ends of the tendon. A misconception in this regard has arisen because muscles are so often cut when stretched or while undergoing contraction. If we accept the "all or nothing" theory of muscular movement, the "tension" must be supported by contraction of a certain number of fibres only and unless more fibres come into contraction when the muscle is cut, there can be no retraction.

The conditions under which retraction occurs, is illustrated in the following case.

A boy was hit on the heel by a broken glass sugar basin which cut the skin and divided the *tendo Achillis*. When the patient was examined, the tendon was found to have retracted up its sheath, but when, in the conscious patient, the proximal end was drawn down to the distal portion, there was no further retraction. The explanation is that the tendon was cut while undergoing active con-



traction and this caused the shortening of the muscle. As the tendon was practically anæsthetic, it was stitched in this position and a perfect result ensued.

Sherrington's work has been the inspiration of other definitions. For example, Holmes and Walshe<sup>(2)</sup> describe tone as a proprioceptive tonic reflex whose purpose is the maintenance of posture; but on page 46 they also say that it is a reflex that keeps all muscles in a state of constant slight tension. In addition, the authors contend there is no tone in the paralysed muscles of spinal animals.

Stanley Cobb<sup>(3)</sup> says that:

Tone is a beautifully graded series of proprioceptive reflexes continually and unconsciously playing their part in our every motor act. By its remarkable specificity it moulds our individual muscles, by its universality it controls our postures.

These two quotations serve to show that the definition is far from clear in the minds of the writers. Both definitions are more or less based on Sherrington's work and an examination of their basis will not be out of place.

Sherrington's observations were made on the decerebrate animal, that is on animals in which the conscious control was abolished. He found that when the brain stem was cut through at a certain place, head, neck, trunk and all limbs went into extension, but the extension was not the only phase of decerebrate rigidity. There was another phase in which rigidity was not so persistent and the tendency for extension to be imposed was less evident. The limbs then assumed any position imposed on them passively or by active reflex contraction. In this phase the "lengthening and shortening" reactions were shown. For example, if the limb were flexed so that the quadriceps tendon was lengthened, the position imposed passively was maintained steadily. In addition the quadriceps muscle was able to resist the same degree of tension independently of the degree of contraction. Similarly if the leg were extended, the quadriceps muscle shortened and the imposed position tended to be maintained.

Now the phenomena of decerebrate rigidity are extremely variable, for at times extension is so persistent that lengthening and shortening reactions are not seen. Sherrington's observations led him to the conclusion that muscle tone was a mechanism for the maintenance of posture and that it concerned mainly the antigravitational muscles.

Bassett and Penfield showed, however, that the flexor muscles of a limb may also exhibit lengthening and shortening reactions and I have seen in the decerebrate animal lengthening and shortening reactions in the flexors of the hip when the animal was placed on its back.

Sherrington's contribution is, then, to consider that tone is a reflex for maintaining posture which means that it is in evidence only in actively functioning muscles, for it obeys the law of reciprocal innervation.

#### Muscle Tone and the Sympathetic Nervous System.

The next most important contribution to the study of muscle tonus was made by de Boer when

he claimed that he produced a change in the tonic condition of muscle by sectioning the sympathetic nerve supply. Langelaan, accepting de Boer's results, maintained that the sympathetic nerves were concerned with plastic tone and the manifestations of tone, such as the presence of the knee jerk that remain after section of the sympathetic nerves, were designated by him contractile tonus. The term plastic or postural tonus was introduced by Sherrington to describe the phenomena seen in the decerebrate animal.

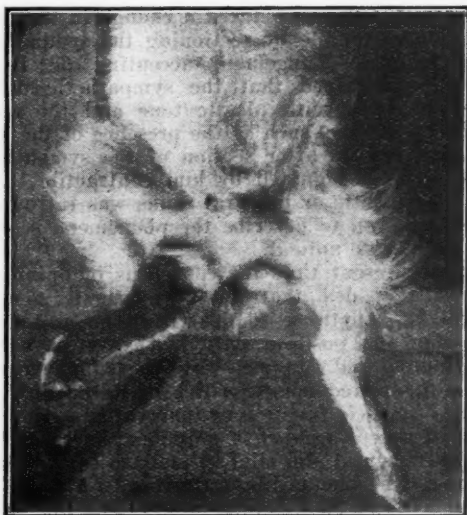
At the present time the consensus of opinion is against the idea that the sympathetic nervous system has anything to do with tone and Cobb, reviewing the position only last year, says that Sherrington and Magnus give an explanation of tonus of striated muscle which needs no dualistic theory of muscle function or innervation. The difficulty in accepting such a statement is that there are experimental and clinical facts to be explained. My own experiments illustrate this. I carried out experiments in the normal animal, in the spinal animal and in the decerebrate animal and the following is a summary of the results.

#### The Normal Animal.

The removal of the sympathetic nerves from the left hind limb of the normal animal did not interfere with the control of the limb. The animal could apparently stand, run and walk in a normal manner, but the differences were noticeable if the animal were placed on its back. In this position the goat extends all four limbs in contrast with the cat which will lie quietly with its limbs flexed. At first the limb from which the sympathetic nerves had been removed, slowly dropped and took up a more flexed attitude. As long as the animal remained quiet, this attitude was maintained, but under the influence of emotion, extension would reappear. These differences were more pronounced when the animal was placed under anæsthesia. After the preliminary induction and anæsthesia became deeper, there was a phase in which lengthening and shortening reactions appeared in the limbs with the exception of the limb from which the sympathetic nerves had been removed. In addition there was a distinct difference in the resistance offered to passive movements by the two hind limbs. The limb in which the sympathetic nerves were intact, offered a definite resistance to passive movements, while the limb from which the sympathetic nerves had been removed, offered practically no resistance.

#### Spinal Animal.

In the spinal animal the spinal cord was cut across in the lower thoracic region, so that the spinal centres for the hind limbs were left intact. The left abdominal sympathetic trunk was removed from the left hind limb. Under these conditions, when the animal was placed on its back some days later, there was a distinct difference in posture between the two hind limbs. The right one tended to be held in the flexed attitude, while the left hind limb took up a more abducted and extended position. The accompanying illustration shows the difference in posture in the two hind limbs when viewed from directly above the subject.



According to Holmes and Walshe the spinal animal does not exhibit tone, but my observations show that there is a distinct loss of posture. There was also a difference in the character of the knee jerk on the two sides and in the tension of the muscles in the left hind limb when compared with the right hind limb. This occurred in the rabbit as well as in the goat.

The reflex movements set up by stretching the right lower limb were followed by two or three movements of flexion, while extension of the left lower limb resulted in only a slight adduction of the thigh.

#### *The Decerebrate Animal.*

In the decerebrate animal similar changes were observed when the extending process was less pronounced and lengthening and shortening reactions were present in the right lower limb. These were frequently absent from the left hind limb. If not absolutely absent they were considerably modified, for there was a distinct loss of resistance to passive movements. When the animal was placed on its back in such a position that gravity would cause the limbs to flex, simultaneous stretching of both hind limbs would cause a difference in the behaviour of the limbs. After releasing the limbs the left one fell immediately under the influence of gravity to the flexed attitude, while the right hind limb returned slowly to a much less flexed position. The results obtained by experiments upon laboratory animals have been repeated in the human subject. This is illustrated in the following series of cases.

#### *The Human Subject.*

In various spastic conditions there is in the conscious patient a tendency for limbs to maintain position and to exhibit lengthening and shortening reactions. This may be seen in congenital spastic paraplegia and in postencephalitic rigidity. In hemiplegia or paraplegia due to trauma or hæmorrhage of the cortex the reactions, though not as consistent,

are often seen. Even if lengthening and shortening reactions are not present in such, the character of the knee jerk is altered in the following way. There is an appreciable prolongation of the relaxation time after extension.

Case I.—In the first human patient subjected to sympathetic ramisection for spastic paralysis the following change was noted after operation. On the side from which the sympathetic nerves had been removed, dorsiflexion of the ankle joint performed passively was followed by an immediate fall into the plantar flexed attitude. But in the limb in which the sympathetic nerves were intact and which served as an excellent control since it was spastic also, the position of dorsiflexion was maintained and the foot fell slowly back into the plantar flexed attitude. This was the immediate change after operation and has persisted for over three years.

In Case II, a boy with spastic paraplegia who had never walked, the lower limbs were so rigid that it was impossible to obtain a knee jerk at all and if lengthening and shortening reactions were tested at the knee, the limb would remain indefinitely in any position imposed upon it passively. This patient had practically no control of the movements of his lower limbs before operation. After ramisection the lengthening and shortening reactions were not present and it became possible to elicit the knee jerk, but the movement was short and sharp and the posture of extension was no longer maintained.

In Case III spastic paralysis of the lower limb was due to a gunshot wound of the cerebral cortex. The patient was paralysed in both lower limbs and the left one could not be moved voluntarily at all, but exhibited good examples of lengthening and shortening reactions. The knee jerk was easily elicited and the step-ladder phenomenon was noted, each successive position imposed by extension being maintained. Positions imposed passively were also maintained, but not so completely as those which were imposed by active reflex contraction. After sympathetic ramisection the step-ladder phenomenon disappeared and the elicitation of the knee jerk was followed by a sharp return to the flexed attitude.

In Case IV the patient was the subject of a post-encephalitic rigidity affecting both lower limbs. There was increased tonus in the dorsiflexing muscles of the toes evidenced by the manner in which the extensors of the toes stood out prominently and held the toes dorsiflexed. Immediately after the operation of sympathetic ramisection the toes on the side from which the sympathetic influence had been removed, lost their posture and there was obviously very much less tension in the dorsiflexing muscles of the toes than in those of the opposite side.

Perhaps the most convincing evidence of the influence of the sympathetic on tone will be found in the change in the ability to balance after operation. One patient with postencephalitic rigidity affecting the right side described the improvement

as equal to 100% as he had no balance at all before operation.

The improvement in balance is an invariable effect of the operation of sympathetic ramisection and is due to the removal of tension from muscles that are poorly controlled.

If we accept Sherrington's definition and at the same time accept evidence that is obtained from laboratory animals and from the human subject after ramisection, we are bound to reach the conclusion that the sympathetic nerves have a distinct and important influence on tone.

Again, according to Sherrington's definition, tone is a proprioceptive reflex mechanism subserving posture and appears in muscles which are undergoing contraction or which have undergone contraction to change an attitude. From his own work the opposing muscles are relaxed and toneless. It must be remembered that these observations were made in decerebrate animals, that is, in animals without conscious control. We know as a matter of clinical experience that under normal circumstances most patients can inhibit the contraction of muscles.

This does not apply to the spastic paralytic and constitutes the initial disability of the patient.

On the other hand, it must be admitted that the removal of the sympathetic nerves does not abolish the conscious patient's power of maintaining a posture. A striking demonstration of the effect of consciousness is seen in the laboratory animal under the influence of light anaesthesia. In two animals from which the sympathetic nerves had been removed from both hind limbs in one instance and from both fore limbs in the other instance, the limbs from which the sympathetic nerves had been removed, were the first to collapse when consciousness was abolished by anaesthesia. This appears to me to indicate that there is a cortical contribution to the maintenance of posture or at any rate we can substitute the effect of the removal of the sympathetic nerves by conscious action.

#### The Clinical Manifestations of Tone.

It is very difficult to state how muscle tone can be demonstrated. Holmes and Walshe claim that muscle tone is demonstrated by the slowness of relaxation after elicitation of the knee jerk. But this is a very variable phenomenon and in my experience may be absent one day and present the next. The retardation of relaxation is increased by exercise and lessened by a period of rest. It is certainly increased when the patient's attention is directed to the movement and when a prolonged relaxation is present after sympathetic ramisection, it may be due to cortical influence alone.

#### Muscle Tone Considered Quantitatively.

If we examine the normal individual at rest, we find that there is not much evidence of definite tension in such tendons as the quadriceps, the *tendo Achillis et cetera*. On the other hand, muscles which are maintaining a posture, such as the facial muscles, must have a certain degree of tension usually. Again, the normal goat exhibited changes in the behaviour of the two hind limbs when the

limbs were maintaining a posture. There was a loss of tension in the muscles from which the sympathetic nerves had been removed, but when the animal was perfectly tranquil and the limbs both fell into flexion, slack appeared in the tendons of the intact hind limb as well as of the one from which the sympathetic nerves had been removed.

#### Definition of Tone.

My observations have led me to suggest the following definition of tone. Tone as evidenced by tension is due to a proprioceptive reflex mechanism and is present to any degree only in muscles subjected to stretching as in maintaining a posture or in muscles about to go into action in response to an idea of movement. It is not present in resting muscles.

#### References.

- (1) Starling: "Principles of Human Physiology," Fourth Edition, 1926.
- (2) Gordon Holmes and Walshe: "Nelson's Medicine," Volume VI, page 44.
- (3) Stanley Cobb: *Physiological Reviews*, March, 1926.

DR. D. S. WYLIE (Palmerston North) thanked Dr. Royle for coming so far to speak to them. As he had asked for some discussion especially in regard to muscle tone in fractures and tendon transplantations, a short talk followed.

PROFESSOR J. MALCOLM (Dunedin) asked Dr. Royle if he could throw any new light on the histological basis of muscle tone.

In reply Dr. Royle said that he did not know.

MR. J. RENFREW WHITE (Dunedin) said that he had never seen a patient with congenital spastic paralysis in whom there was not some degree of voluntary control. Dr. Royle said that this was what led him in the first place to begin his investigations on the subject. It could not be explained by reciprocal innervation, but only by sympathetic control.

MR. HAMILTON RUSSELL (Melbourne) said that he thought that they did a great deal of harm by putting excessive weights on fractures; he considered that a very light weight was sufficient.

DR. ROYLE did not agree with this, but considered that a fracture should be reduced without difficulty under anaesthesia and a light plaster exoskeleton applied while there was no muscular spasm.

DR. J. L. A. WILL (Christchurch) thought that extension in fractures at once produced muscle tone and favoured the three-stage plaster method to avoid this.

Dr. Royle agreed with these remarks.

#### VISCEROPTOSIS IN RELATION TO POSTURE.

By J. RENFREW WHITE, M.B., Ch.M. (New Zealand),  
F.R.C.S. (England), F.A.C.S.,  
Dunedin.

#### Introduction.

For the past two years I have been engaged in a study of body mechanics in the young and healthy. I have examined from this point of view several hundreds of primary school children, several hundred high school girls and several hundred young women, probationer nurses and university undergraduates between the age of eighteen and twenty-one.

At the same time both in private and in hospital practice I have accustomed myself in all chronic



cases to make a similar postural examination and I have been drawn irresistibly to the conclusion that a considerable proportion of chronic ill health, disability and disease is due directly or indirectly to the gradual development of processes which themselves are the result of lifelong habits of mechanical misuse of various parts of the body.

We are, of course, familiar with the conception of deformity and disturbances of function following habitual misuse in the case of the limbs and of the spine; but we have not, I am sure, as yet grasped the significance in relation both to health and to disease of habitual misuse of the trunk with depression or perversion of visceral function.

I would like at the outset to pay a tribute to Dr. Joel E. Goldthwait, of Boston, who first opened my eyes to the importance of postural habits on physical development and of this in the maintenance of health and in the production of disability and disease.

It seems to me that there is here a fruitful field for research, in investigating the effects on health of departures from the normal of anatomical structures and relationships induced by defective use and this the whole body over. Such a research would not be simple as regards time; it would require the following up of a considerable number of patients with controls for a life time and even entering into the next generation; in principle, however, it would be relatively simple, being a study of mechanics applied to the human body.

Even with the relatively small amount of thought that I have given to the subject, and the relatively small number of patients examined, I feel very strongly that this study represents a great and fruitful field for the prevention of much chronic ill health and disability in the next generation. It is, moreover, a field for prevention, in which by simple means and inexpensive organization, a system of physical education in the schools based on a proper understanding and training in body mechanics, much could be accomplished within a few years.

The particular portion of this general subject of body mechanics in relation to health and disease that I have chosen as the subject of this paper, is that of the relation between trunk posture and the position and functioning of the abdominal viscera, the relation between defective bodily posture and visceroptosis. Visceroptosis has hardly as yet been recognized as essentially an orthopaedic problem, a problem requiring a knowledge of the mechanics of the body as a whole for its understanding, for the proper conception of its pathogenesis and for the gaining of adequate and justifiable indications for its treatment. It is the object of this paper to attempt the outlining of such a conception.

#### The Causes of Visceroptosis.

According to this conception visceroptosis is due to the combination and interaction of two causes, one congenital, the other largely environmental: (i) Congenital looseness of attachment of the abdominal viscera, (ii) life-long habits of defective body use, especially important during the growing period of

life, as then giving a set to the outward shape and an alteration in internal relationships and position to the abdominal viscera, a state of affairs that tends to become progressive with advance in years, especially of a life lived under the conditions of modern civilization.

Both these conditions tend to occur most frequently and to occur in their most extreme form in that type of human being hereditarily destined to a tall, slender body build.

In some cases, no doubt, we meet with the effects of visceroptosis in patients with a perfect body shape and use; in these the congenital factor alone is responsible for the marring of a perfect function. Such conditions, however, are relatively few; in most patients with visceroptosis caused by a variable amount of the congenital factor and giving rise to symptoms, there is a considerable departure from the ideal of body carriage and use, a considerable postural defect.

#### The Two Natural Postures.

When in the erect position the human body naturally assumes, according to circumstances, one of two different types of posture: (i) The "passive" or "relaxed" posture or (ii) the "active" posture.

There is a tendency for the latter to be assumed especially and most typically during effort; it is characterized by a straightening out of the curves of the spinal column, an elevation of the chest, the head carried well back, the upper part of the abdomen at least as prominent as the lower. The passive posture is one associated with muscular relaxation and is seen typically after effort when the muscles are tired and hypotonic. The spinal curves become marked, the head droops forward, the chest descends into a position approaching that of full expiration, whilst the relaxation of the abdominal muscles together with the low position of the chest and diaphragm results in a relative descent of the abdominal viscera with a change in external configuration of the abdomen, the lower part of which becomes very much more prominent than the upper. Radiograms of the same person show a considerable difference in the level of the stomach in relation to the skeleton in the two postures.

One of the worst effects of present day life of civilized people is the tendency from a variety of causes to replace the active phase of posture more or less continuously by the passive or relaxed. What should be merely an occasional physical luxury, under the stress of such factors in our modern environment as occupation, physical and mental fatigue, depressed and abnormal metabolism through faulty diet, the use of furniture and certain elements in our clothes, becomes a day long and life long habit. The frequent or habitual assumption of this relaxed posture during the growth period of life has serious developmental effects on the various organs and tissues of the body which in the course of time come to be associated with depression and perversion of various elements in their functions. Thus this life long habit becomes a potent cause of physical disability and an important predisposing cause of disease.



Method of Observation, Record and Classification.

Both the young and healthy and the actual patients have been observed and measured in the same way; these observations and measurements have been made the basis of a classification.

The following are the points that have been noted:

(i) The inclination of the pelvis, (ii) the extent of lumbar lordosis, (iii) the extent of dorsal kyphosis, (iv) the position of the head forward in relation to the trunk, (v) the relative prominence of upper and lower parts of the abdomen, (vi) the position in which the chest is held, whether nearer that of full inspiration or nearer that of full expiration, (vii) the general shape and diameters of the chest, (viii) the size of the subcostal angle.

The departures from normal were divided into four grades. Grade A is characterized by approximately perfect postural relations between the various elements of the trunk, though not necessarily by perfect proportions and development. This included a normal inclination of the pelvis, a relatively straight back with but the slightest degrees of spinal antero-posterior curvatures, an erect head,



FIGURE I.



FIGURE II.



FIGURE III.



FIGURE IV.

the upper segment of the abdomen as prominent as the lower, a chest held in a position at any rate not below the midway point between full inspiration and full expiration and a subcostal angle not below 60° degrees (see Figure I).

In Grade B there is a normal or perfect relation of the pelvis and the lumbar spine with a varying degree of the forward head, a low, flat chest, a prominent lower segment of the abdomen and a round back posture (see Figure II).

In Grade C the posture is defective in all the elements enumerated under B with in addition an increase in the lumbar lordosis (see Figure III).

In Grade D all the elements enumerated above as regards trunk posture are defective in their relations from the pelvis upwards (see Figure IV).

In each of these three latter grades the condition is further classified into four classes according to the degree of defective posture within each grade. Thus each patient falls into one or other of the following classes: A, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>4</sub>, C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub>, D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub>, D<sub>4</sub>.

TABLE SHOWING RESULTS OF THE POSTURAL EXAMINATION OF GIRLS.

Percentage in Each Grade or Class.

Grade.	Class.	Primary School Girls, Ages 8 to 11.		High School Girls, Ages 14 to 16.		Girls Between 18 and 21.	
A		11	11	10	10	6	6
B	A	15	22	14	22	12	20
	B <sub>1</sub>	7		7		6	
	B <sub>2</sub>	0		1		2	
C		26	40	14	35	14	40
	C <sub>1</sub>	11		17		25	
	C <sub>2</sub>	3		4		3	
D		13	27	12	33	13	43
	D <sub>1</sub>	11		16		21	
	D <sub>2</sub>	3		5		7	
	D <sub>3</sub>	0		0		5	
	D <sub>4</sub>						
	B <sub>2</sub> , B <sub>3</sub>						
	C <sub>2</sub> , C <sub>3</sub>	35		50			58
	D <sub>2</sub> , D <sub>3</sub> , D <sub>4</sub>	6		10		14	
	B <sub>2</sub> , C <sub>2</sub> , D <sub>2</sub> , D <sub>4</sub>						

Let us now see how the various groups were classified.

*Result of Examination of Primary School Girls.*

In the table the classification of the results of the examination of primary school girls is shown.

The important facts are as follows:

Girls with perfect or approximately perfect postural relations represented 11%.

Girls with slighter degrees of postural defects, partial or general (classes B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub>) represented 54%.

Girls with higher degrees of postural defects (classes B<sub>2</sub>, B<sub>3</sub>, B<sub>4</sub>, C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub>, D<sub>2</sub>, D<sub>3</sub>, D<sub>4</sub>) represented 35%.

*Result of Examination of High School Girls.*

In the table the results of the examination of the high school girls is also given. The corresponding figures are: Class A 10%, classes B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub> 40%, other classes 50%.

*Result of Examination of Girls Between Eighteen and Twenty-one Years of Age.*

The results of the examination of girls between the ages of eighteen and twenty-one are also given in the table. The corresponding figures are: Class A 6%, Class B<sub>1</sub>, C<sub>1</sub>, D<sub>1</sub> 39%, other classes 58%.

These figures show that a very considerable percentage, a percentage increasing with advance in age from six to twenty-one, of the children and young people of the rising generation manifest a distinct tendency towards visceroptosis. We know that this tendency is not in the least likely to diminish, but rather to increase and bear fruit in middle and later life.

*Visceroptosis Not Wholly or Primarily an Abdominal Condition.*

In regard to one of its causative factors, the one most amenable to prevention and cure, postural defects, visceroptosis is not primarily or chiefly an abdominal condition, but rather an abdominal result of a far more widespread anatomical disorder. As long as visceroptosis is encouraged by the life long habitual assumption of a relaxed posture, it is not to be classed aetiologically as a wholly abdominal disorder. Nor in regard to its effects is it wholly abdominal. The relation that exists between visceroptosis and chronic intestinal stasis with its protean and widespread effects and between visceroptosis and neurasthenia with its protean manifestations provide sufficient evidence of the truth of this.

Neither in regard to its treatment should visceroptosis be regarded as an abdominal problem. Surgical measures designed to refix one or more of the abdominal viscera must surely be doomed to failure, especially if not followed by reeducation and redevelopment of the body as a whole resulting in a new body posture and mode of use. This form of treatment is based on a partial view of one factor only of the causation and that the least remediable, namely, looseness of visceral attachment. Exercises for the abdominal muscles and the wearing of abdominal belts are means of treatment based on too narrow a view of the mechanical defect. The primary defect is far more widespread than a mere

weakness or lack of tone of the abdominal muscles. It consists of a general derangement of the mechanics of the body as a whole and not merely of the abdomen and its musculature.

By reason of its relation to body mechanics generally, visceroptosis is a fit subject for orthopaedic study and treatment, but it would be a great mistake to regard it as a subject or problem for orthopaedic surgeons alone. It is a subject of daily importance to physicians, obstetricians, gynaecologists and abdominal surgeons. It is necessary that all these be taught in the future the essentials of body mechanics and that in treating this condition at any rate they have their vision widened and lifted from a narrow preoccupation with the particular organs in the abdomen in which they are specially interested or with the abdomen itself as a whole, to see the patient as a whole and to learn to give proper consideration to all of the factors that are concerned with the production of visceroptosis.

*The Treatment of Visceroptosis.*

The orthopaedic element in the treatment of visceroptosis, as distinguished from the surgical element, should consist of such a reeducation of the individual as will lead to the assumption of a posture different from his habitual. What is required is a process of physical education of the individual in the recognition of his own mechanical defects and of the corrected position that he should strive for, in learning the best and easiest methods of attaining and holding this posture and in training the muscles concerned in strength and tone so as to render them fit to assist in maintaining this correct posture.

The method employed in reeducation is illustrated in Figure V.



FIGURE V.

This is a very different form of treatment from mere exercise of the abdominal muscles alone or from the prescribing of various sorts of abdominal belts and supports.

This process of physical education is not the prescribing of a system of exercises. It is far more a training of the sensory than of the motor parts of postural reflexes, a training in kinæsthesia.

#### The Prevention of Visceroptosis.

The making of such a postural training as the fundamental basis for systems of physical training in our schools should have a great influence in preventing visceroptosis in the next generation. This indeed seems to me one of the simplest and most hopeful fields for prevention on a large scale at present offering itself to the profession.

Physical education with this postural basis must take a somewhat similar place in our modern life as it did in that of ancient Greece.

This is impossible unless more attention is paid in our medical schools to the study of body mechanics in relation both to health and to disease. Biochemistry and biophysics are regarded as very important parts of both physiology and pathology; why not biomechanics as well?

DR. H. S. NEWLAND (Adelaide) thanked the speaker for having put a subject before them in a new light. He said that he thought the postural treatment for visceroptosis should begin in babyhood and be continued during the growing period of life if it was to be of much use.

DR. R. HAMILTON RUSSELL (Melbourne) said that after many years of surgical experience he had come to the conclusion that the surgical treatment of visceroptosis was valueless, if not criminal. Mr. White's remarks had made the subject so clear that he felt the postural treatment was undoubtedly the correct one.

DR. J. A. POTTINGER (Invercargill) thought that the whole trend of modern life was helping to produce this condition and he failed to see with the use of the present-day school furniture and the like how they could rectify the faulty posture by a system of exercise. He thought that the only remedy was to return to a primitive condition.

DR. T. A. WILL (Christchurch) pointed out that most of Mr. White's patients were children who had been educated at the old type of school. There was, however, in New Zealand a society which had originated in Canterbury and which was known as the Fresh Air Schools Society, where the children were in open-air class rooms and were encouraged to exercise. He felt that if this system were carried out throughout the country, it would make for the production of a race belonging to class A.

DR. N. D. ROYLE (Sydney) agreed that this was a question for the orthopaedic surgeon.

Mr. White replied by pointing out that the treatment which these patients needed, was not a system of exercises, but a reeducation of their postural centres and a training in sensation. He then outlined the process by which a child could be taught habitually to stand correctly. He said that even in middle life he was able to obtain a fair degree of correction of visceroptosis by this method.

He paid a tribute to Dr. Joel Goldthwaite, of Boston, who had spent his life at this work and from whom the speaker had first obtained the stimulus to make these investigations and to regard the body as one mechanical whole.

#### SECTION XII.—RADIOLOGY.

##### PROGRESS OF RADIOLOGY.

By STANLEY S. ARGYLE, M.B., M.R.C.S., M.L.A.,  
Melbourne.

It is now thirty-one years since Röntgen made the epoch making discovery of X rays and for twenty-two years of that time I have actively practised the

application of that discovery to medicine and surgery both in its therapeutic and its diagnostic aspects.

I have, therefore, thought that it might be desirable to recapitulate some of my experiences during that period, to draw attention to the progress that has been made, to discuss some of the problems that have been met with and overcome and to indicate to some extent the directions in which further development may be expected to eventuate.

The announcement of the fact that radiations could be produced which, while penetrating some opaque materials, could be made to effect chemical changes similar to those produced by light in photography, immediately attracted the notice of the medical world. The value of the discovery that metallic foreign bodies could be located in flesh and the situation of fractures in bone determined was soon made manifest and a new method of diagnosis came into being.

On the therapeutic side Freund, of Vienna, in 1897, about eighteen months after Röntgen's announcement, after reading an account in a newspaper of a dermatitis which had occurred in a man who had been experimenting with X rays, carried out some experiments himself on *navus*. Freund gave daily exposures of two hours in length for ten successive days with the tube ten centimetres from the growth without any ill effects. The X ray factors were not stated. He exposed another person for forty-two hours and produced an X ray burn of the fourth degree with necrosis and serious constitutional effects which took two months to develop.

During the next three years successful treatments of many skin affections, including rodent ulcer, were reported from different countries and X rays became recognized as an accepted therapeutic agent. But there was a price to be paid.

Within the following few years many cases of both acute and chronic burns were reported amongst X ray workers of all kinds, doctors, nurses, physicists, mechanics and patients, while several deaths were to follow later.

Slowly but surely it was realized that in X rays we had a potent force for good or ill and that careless or ignorant use must inevitably result in disaster to operator or patient or both.

Thus the period of X ray protection dawned and physicists and pathologists collaborated in research to ascertain the explanation of the tissue changes.

The first fact that emerged was that the results of overdosage were delayed in their appearance and cumulative in their action.

It was next made clear that, in addition to the time factor, intensity of the irradiation and distance from the source of the rays must be taken into consideration when arriving at dosage.

Just about this period, 1904, I commenced X ray work, having been attracted by reports in the journals of successful work in carcinoma of the breast.

A short account of my first case both as to apparatus used and the dosage administered may prove of interest.

The case was one of scirrhus, pronounced inoperable by a consulting surgeon of Melbourne. There was a large lump in the left breast of stony hardness, with enlarged axillary glands, the nipple retracted, the skin bound down and wrinkled and a hard nodule in the cervical region just above the clavicle. The hand, forearm and arm were red and greatly swollen. X ray treatment was commenced on June 6, 1904, the apparatus used being a fifteen centimetre (six inch) coil with a hammer interrupter, energized by an eight volt accumulator battery, with four ampères of current in the primary circuit and a ten centimetre (four inch) alternative spark gap. The tube was placed with its glass wall fifteen centimetres (six inches) away from the skin surface.

Exposures of five minutes' duration were given daily with some interruptions for two months until fifty-two exposures had been given, when a slight dermatitis with considerable bronzing appeared. Careful measurements of the tumour and the swollen arm were taken at the outset and a great reduction in size of both was apparent at this stage. The arm which had been quite useless and carried in a sling when treatment was commenced, was brought into use again and the sling abandoned.

Treatment was continued intermittently for five months more, when, owing to metastases appearing in the other breast and presumably in the lungs, it was finally abandoned on January 17, 1905.

During the whole of this time the patient suffered no pain in or near the growth. Death occurred on May 7, 1905, or nearly a year after treatment was commenced. In the light of our present knowledge the case was hopeless from the start, but it is interesting from the point of view of the technique adopted, the apparatus used, the dosage given and the relief obtained.

About this time I used a large Wimshurst static machine as a source of energy for the X ray tube and obtained some satisfactory results in the treatment of some dermatological conditions. Owing, however, to the great length of the exposure required and its unreliability in damp weather, I found it quite unsatisfactory for diagnostic work.

My next outfit consisted of a thirty centimetre (twelve inch) locally wound coil energized by thirty volt accumulators and interrupted by a McKenzie-Davidson break with kerosene as a dielectric. Bare tubes were used and filters were unknown, but by the use of fractional doses over a long period of time with careful observation for any indications of early reaction I was fortunate enough to escape disaster in the shape of acute X ray burns in any case.

In cases where treatment was spread out over long periods, however, as in hypertrichosis where excellent immediate results were obtained, I discovered as the years went on that telangiectases and other evidences of chronic X ray action frequently set in later. These were in some instances of so disfiguring a

character, even when filters were used, that I finally gave up this method of treatment for this condition altogether.

The tubes used about this time were called Crookes's tubes and were modifications of the tubes used by Sir William Crookes in his experiments on the conduction of electrical discharges through gases. The bulbs were from four and a half to twenty centimetres (three to eight inches) in diameter, blown chiefly from soda glass, which fluoresced green on excitation. The anodes were of copper, thinly coated with a skin of platinum, which frequently perforated after prolonged use at the focal points and destroyed the definition of the tubes for future work. The penetration of these tubes varied with their use, the increase taking place as the tubes grew older, so that as time went on it became more and more difficult to get a current to pass through them, with the result that the tubes ultimately became unfit for use with the ordinary electromotive force that was used in those days. It, therefore, became necessary for an operator to have a large number of tubes available in order that he might cope with the different varieties of work that had to be done. That is to say that a tube which was useful for the taking of the extremities of young people, was absolutely of no use at all for the taking of pictures of the deeper parts of the body and tubes which were quite good for the taking of such portions as the skull or pelvis were utterly useless when applied to the taking of extremities in a young child, the more penetrative tubes practically making no definition between the soft parts and the bone.

The difficulty was accentuated by the fact that we had no means whatever for varying the state of the vacuum. That is to say, there were no devices by which the penetration of the tubes could be varied at the will of the operator after the tube had got too hard for ordinary work. There were at that time only two methods by which a hard tube could be softened sufficiently to bring it into use again. The first of these was to put the tube aside for a considerable period to allow the occluded gases to escape from the metal and walls of the tube. The second method was to bake the tube in an oven for a considerable time and bring about in that way the same result. Neither of these methods was very satisfactory and seldom resulted in much prolongation of the life of the tube. As time went on, however, various devices were attached, by which either subsidiary currents were passed through the tube, which resulted in rendering the conduction of electrical discharges through it easier, or means were obtained by heat and otherwise of admitting extra gas to the tubes to provide more molecules for the passage of the current from the anode to the cathode.

In the *Archives of the Röntgen Ray* in 1907 in reference to this difficulty it was pointed out that: "It is a constant source of regret that the vacuum of a focus tube tends to deteriorate with use. One by one the various methods proposed to obviate this difficulty have come and vanished, for each and all



have failed to satisfy the requirements of an ordinary work-a-day experience."

The difficulties caused by the perforation of the anode were afterwards overcome by the use of solid plates of the rarer metals, such as platinum itself, tungsten, iridium and the like.

Overheating of the tubes was also got over by the waterjacketing of the anode. The variations of penetration were ultimately solved by the invention of the now thoroughly familiar Coolidge tube, in which the necessary vacuum is provided in one tube, but in those early days these various difficulties presented a very real problem from day to day for the operator in X ray work.

Another difficulty encountered with the early makes of tubes was the result upon the vacuum of reverse currents from the coil. These were ultimately met by the use of various kinds of valve tubes inserted in the secondary circuit. Valve tubes themselves, however, created yet another complication, because as time went on, their vacuum also varied with the amount of use and the classes of current passed through them.

One of the greatest difficulties met with in the early days of radiography was the necessity for the use of ordinary photographic plates for the taking of radiographs. These plates, while producing quite decent looking pictures, had not anything like the depth and contrast that the modern special plates made for the purposes of radiography have. The efficiency of the modern double-sided film is reflected in the reduction of exposure required in the taking of a radiograph with similar currents to those used in the old days and, when double intensifying screens are added to this, one realizes how the extraordinary short exposures of today are effected, with factors not very different from those used with the older apparatus. An extremity is taken today in five seconds, which under old conditions took at least five to twenty minutes.

Williams, of Harvard, in his textbook published in 1902, gave the following exposure table for use with "an apparatus of considerable power with a tube of low resistance": Hands and feet two minutes, forearm three minutes, elbow four minutes, knee four and five minutes, shoulder five minutes, kidney four and a half to seven minutes, hip five to eight minutes.

The tube was twenty-six inches from the plate.

Before the use of intensifying screens came in, I attempted to obtain a similar effect by placing a silver coated metal plate as a backing to the photographic plate or film and, although not so efficient as the modern intensifying screen, I quite definitely improved the quality of my radiograms thereby.

The taking of dental radiograms was particularly troublesome in the early days. I used to make my dental films from vest pocket Kodak films, cut to a suitable size and wrapped up in black paper covered with thin rubber tissue, which I sealed with chloroform. This involved a lot of tedious work in the dark room for each particular dental case. Compare this with the modern swift method of

using the special film prepared for dental work, with its pliable metal backing. Dark room development was also a long and very tedious process, dish methods being used and very slow developers. Frequently after a very moderate day's work I did not finish my developing until late into the night. This, of course, resulted in considerable delays in the furnishing of reports which today are obviated by the use of the tank method, when patients can be reported on within half an hour or less.

Accessory apparatus was also of the most primitive character. X ray couches and screening stands were practically unobtainable and those that I used, were made to my own design by an ordinary cabinet maker. Protective gloves were unknown and my first pair were made from an ordinary pair of leather gardening gloves, impregnated with oxychloride of bismuth by a precipitation process, while I protected my face with a large leather helmet, into which had been fitted a piece of lead glass opposite the eyes. My appearance when wearing these devices must have resembled that of the famous bushranger, Ned Kelly, in his armour. Fluorescent screens were originally quite without protection for the observer, but were later on covered in front by a sheet of lead glass and at the back by a filter of 0.5 millimetre of aluminium. While treating a patient therapeutically, I protected myself generally with a stand made from an ordinary piece of six millimetre (quarter inch) boiler plate. After Sir Joseph Thompson had made his announcement that the secondary rays from iron were particularly dangerous to X ray workers, I coated this stand with four pound lead. In order to localize the action of the rays through the area under treatment, I protected the patients by covering them with cardboard, upon which I pasted lead foil and in facial cases I used an ordinary theatrical mask treated in the same way, out of which I cut windows of suitable size for the parts to be treated. I believe that these masks were responsible for the telangiectases, which occurred in some of my patients at a later date.

One of these primitive devices was responsible for an accident which might have had very serious consequences indeed to myself. While adjusting a cylindrical compressor in a kidney examination, the clamp which held the X ray tube slipped and the tube fell upon the metal compressor within a few inches of my face. The tube exploded and many fragments of glass were hurled into my eyes to such an extent that it was impossible for me to close the lids. A medical friend in the next room extracted these glass fragments, some of which were very large, from between and beneath my eyelids. No serious injury was done to the conjunctiva or the cornea, but I might have completely lost the sight of both eyes by this accident.

While my eyes were being attended to, the patient was lying upon the couch in a state of terror, which is better imagined than described. I might point out that nothing would persuade that patient ever to enter my consulting room again.

Early screening work was done by means of an apparatus known as a fluoroscope, which simply consisted of a fluorescent screen attached to a large triangular box, the apex of which was used as an eye piece. This was used in an ordinarily lighted room and was naturally not very satisfactory, when one considers that no effort was made for the accommodation of the eyes to darkness.

As the years went on it became clear that not only were X ray methods extremely valuable in the diagnosis of bone lesions and in the location of opaque foreign bodies, but as a diagnostic agent in diseases of the chest they were indispensable for the physician. A little later by the ingestion of opaque, inert and unabsorbable substances the whole gastrointestinal tract came under observation and much valuable information was placed at the disposal of both physician and surgeon.

This method was first introduced by Rieder in 1904, who took skiagrams of the stomach after the ingestion of a meal containing bismuth subnitrate. Later, it was found that more information was obtained by screening, assisted by palpation and still later Haudek introduced the double bismuth meal, which gave very valuable data as to the motility of both the stomach and the duodenum.

I well remember the incredulity and scepticism with which the now well recognized and accepted J shaped picture of the stomach was received both by anatomists and surgeons alike. The greatest difficulty then encountered was to arrive at a true conception of what was the normal appearance of these organs. In fact, even today with a vast amount of recorded information, it is sometimes extremely difficult to say where the normal ends and the pathological begins. Very serious difficulties were also met with through the occasional occurrence of toxic symptoms after the ingestion of some of the bismuth salts, chiefly the subnitrate. Later on, principally on the score of cost, both the safer carbonate and oxychloride of bismuth were superseded by the now universally used sulphate of barium.

Only one case of toxæmia came under my notice at this time, when a sinus from a condition of spinal caries was freely injected with an emulsion of bismuth subnitrate and disclosed a large psoas abscess in the groin. Symptoms of metallic poisoning developed and the case terminated fatally after the opening of the abscess and the establishment of free drainage. It was never clearly established whether these cases were due to impurities of the bismuth salt used or the setting free of nitric compounds from chemical action within the body. Today the only salt used for ingestion is barium sulphate which, as far as I know, has never been responsible for any toxic symptom.

Very grave differences of opinion, however, then existed between different X ray observers as to the interpretation of both radioscopic and radiographic appearances. For instance, Holzknecht, of Vienna, insisted that a residue in the stomach six hours after ingestion was diagnostic of organic obstruction

of the pylorus. Today we know that it is not necessarily so.

The outbreak of the Great War in 1914 found the Army Medical Services of the nation with no definite X ray organization, no standardized equipment and no defined policy as to the methods to be adopted under war conditions. In Australia, where the medical services were organized on a field ambulance basis, no provision for X ray work was in existence at all, except for the fact that some of the radiologists were honorary reserve officers, liable to be called up for service in their respective hospitals, if required. When organizing the medical services of the Australian Imperial Forces, the late General Williams, Director-General of Medical Services, sent me a copy of the British Army X ray equipment as used in the South African War for a report as to its suitability for his requirements. The list was ridiculously out of date and quite useless and I advised him accordingly. He then asked me to undertake the organization of an equipment for use under service conditions for the Australian Imperial Forces. The Australian Red Cross and other patriotic bodies throughout Australasia raised the necessary funds and four standard equipments were obtained with great difficulty from various firms dealing in X ray apparatus throughout Australia. A fifth apparatus was fitted into a motor car for use as a mobile unit wherever required. It carried its own tent, a light-proof inner compartment for developing, couch, tubes, accumulators and one month's X ray supplies. It also charged its own accumulators from a small dynamo attached to the engine. Its crew consisted of one X ray operator, a skilled electrician and one motor mechanic, capable of effecting any repairs required. It may interest New Zealand hearers to learn that this plant did all the X ray work for the New Zealand Medical Services at Abassieh, near Cairo, during the first six months of the Gallipoli campaign. Unfortunately, owing to the inability of the headquarters staff to understand the usefulness of such a mobile unit well forward close behind the front line, this unit was never given a chance to prove itself as originally intended. France and Italy, however, did use such outfits and much useful work was done among the scattered smaller hospital units all along the line, but the first of these was conceived and carried out in Australia, although never permitted to carry out its functions under actual war conditions.

Indirectly the Great War had a marked influence upon the progress of radiology. It was soon discovered that to a very great extent the warring nations were dependent upon Germany for their supplies of apparatus, vacuum tubes and photographic chemicals. All the induction coils included in the outfits, which I got together for the Australian Imperial Forces bore the name of an English firm but were of German origin. This was discovered when the vulcanite shells were removed for the provision of better insulation to meet service conditions. The packing beneath consisted in every case of newspapers published in Germany. Thrown upon her own resources, Great Britain set to work

to make her own apparatus even to the manufacture and blowing of glass for vacuum tubes.

I spent an interesting day in London in 1917 watching the various stages of manufacture of an X ray tube from the blowing of the bulb to the formation of the vacuum.

The enormous demand for X ray apparatus and material stimulated manufacturers to greater and better efforts. Physicists, mechanics, engineers, chemists, radiologists and electricians cooperated to improve, strengthen and to simplify all aspects of radiological work. The entry of the United States of America into the war set all the best electrical manufacturers at work to standardize and to improve their apparatus. In Great Britain and in America great corporations were formed out of many smaller manufacturing firms. Research workers were called in to assist, with the result that a remarkable impetus was given to the science and art of radiology. Where before the war a few hundred X ray workers were stumbling along with very imperfect instruments and tedious photographic developmental processes, today thousands of radiologists have sprung up in every country with almost perfect instruments of precision and simplified technique, both in the operating room and the dark room.

The old factorial problems of exposure-technique were carefully worked out and included in the apparatus itself, which today stands out as an embodiment of strength and simplicity.

Of course, the interpretation of the results obtained, both radiographic and radiosopic, still require careful study and prolonged experience before a radiological diagnostician can hope to attain the status necessary to enable him to claim the title of a radiologist.

To meet this difficulty the universities of Cambridge and London have established Diplomas of Radiology and Electrology and the day may now be said to have passed when rule of thumb methods and self taught operators worked their will upon a long-suffering, awe inspired public and credulous profession often to their mutual undoing.

Limited as X rays were at the outset in diagnosis to foreign bodies and fractures, the use of inert opaque chemicals in the gastro-intestinal tract has gradually increased the scope of the method so as to include many organs previously considered beyond the reach of its probing and illuminating finger. "Veil upon veil has been lifted, but there is still veil upon veil behind."

Today the ventricles of the brain, the thecal sheath of the spinal cord, the gall bladder, the calyces of the kidney, the lumen of the ureter and the contents of the peritoneal cavity have each and all yielded their secrets to the searching X ray assisted by harmless solutions and gases introduced either directly from without or indirectly through the circulation.

Who can say or even dream what the next twenty years will bring in the increased usefulness to mankind of the science and art of radiology?

#### KÜMMEL'S DISEASE: POSTTRAUMATIC SPONDYLOPATHY.

By W. R. STOWE, M.R.C.S.,  
Palmerston North.

THIS paper is the outcome of a striking experience in 1918. A very much deformed old man hobbled into the rooms on two sticks. On sight his condition was obviously due to spinal curvature of an extreme grade. His posture and obesity were anything but favourable to good skiagraphy. Eventually a film was obtained which showed complete collapse of the first lumbar body on the left side. There was no history of disease, only that of an accident twenty years ago, his horse rolled on him. Spinal injury was not diagnosed at that time. He was not incapacitated for more than a few weeks. In course of time spinal deformity developed, but its cause from the pathological point of view remained a mystery. A search through such literature as was available resulted in the discovery of a page and a half on Kümmel's disease. This was sufficient for the purpose of diagnosis, but it did not explain why the vertebral bodies slowly collapsed after such an accident as that mentioned.

In January of last year during the bathing season a young man of twenty dived on to the river bottom through three feet of water. He was in hospital for a week. During that time no evidence of a spinal injury was obtained. A month later he complained of pain in his neck and kyphosis in the same region was apparent. A skiagram showed collapse in the anterior parts of the third, fourth and fifth cervical vertebrae. There was no luxation (see Figure I). Eight months later the condition was unchanged, except that the contours were smoother. There was still a certain degree of disability due probably to muscular fatigue in the absence of skeletal support. The case was referred to Dr. A. E. Barclay, of the Manchester Infirmary.



FIGURE I.  
Posttraumatic changes in cervical spine.





FIGURE II.  
Posttraumatic changes in fifth lumbar segment.

He said that there was no parallel to it in his records.

The literature on the subject is comparatively scanty. The Librarian of the Royal Society of Medicine sent out all he could find, namely, three papers, one by Dr. Fosdick Jones read before the Orthopaedic Section of the American Medical Association (1923) is certainly the most comprehensive yet published. It is based on Kümmel's original description (1895) and fifty reports published in Europe at various intervals since. Kümmel's original statement defined the condition as a post-traumatic spinal deformity. The essential predisposing cause is trauma, direct and indirect. There



FIGURE III.  
Complete atlanto-axoid dislocation.

is a stage of initial injury with varying degrees of surgical shock. The second stage is one of relative well being in which the patient carries on his occupation. There is a third stage in which after weeks, months or even a year an angular kyphosis appears with resumption of pain. The pain is local over the spine or radiating down the extremities, of a neuralgic character, often very severe.

Kümmel was not really the first observer of the condition. In 1892 Dr. Verneuil, of the Paris Medical Academy, reported on obscure cases of vertebral fracture caused by violent muscular contractions in which girdle pains and delayed kyphosis were the outstanding features. In 1896 he described a case of kyphosis at the ninth dorsal segment occurring four months after a violent effort in avoiding a fall on the ice, but he attributed the pain to rheumatism affecting the abdominal viscera or muscles.

From 1895 on reports appeared almost yearly. In all up to 1921 eighty-four cases were reported, that is a little over three *per annum*. The nature of the accident is stated in twenty-three only of these. In eight at least violent muscular effort must be held to account for the injury to the spinal bodies. In seven falls from various distances from thirty feet down to fifteen are responsible. In the remaining seven the accidents were a violent blow at football, a landslip, the patient was knocked down by a motor car, the patient tripped and in falling thought he struck a tree, the patient was crushed by an earth fall in a sand pit, a boy fell over heavy iron wash tub and struck the lower portion of his spine, a patient on lifting a heavy piece of timber experienced sudden, very severe pain in back.

In some of the cases it is impossible to say whether direct violence or the sudden extreme bending or torsion was responsible for the subsequent spinal deformity.

In none of the cases quoted are X ray examinations mentioned. The spinal angularities were clinically obvious before the diagnoses were made.



FIGURE IV.  
Specimen illustrating atlanto-axoid dislocation—lateral view.



I am now justified in coming to the following conclusion. All victims of the accidents described should be kept under observation and examined by a radiologist at intervals until the presence of a post-traumatic change in the vertebral bodies can be ruled out.

I shall now consider what the immediate changes in the vertebral body are at the time of the accident. Consider the probable effect of sudden compression or torsion on a spongy mass of bone with a very thin cortex, on a vertebral body enclosed between two discs of fibro-cartilage. When the elastic limit of the cartilage is reached, one of two things must happen, either impaction of the trabeculae or disruption by a tearing action. In both cases it is safe to assume that hæmorrhages, more or less minute, occur.

Certain *post mortem* data are available. Ludloff (Dresden, 1920) published autopsy findings in one case in which death occurred shortly after the accident. There was no compression fracture, but contusion and rupture of the vessels in the spinal segments was found. His conclusion was that nutrition was impaired, that necrosis of the spongio-trabeculae supervened resulting in collapse of the vertebral body and so angular deformity.

Kümmel's disease is a serious condition. Only close cooperation between the surgeon or general practitioner and the radiologist will save the patient from the very disabling kyphosis. There are many cases in which the structural change is not extensive. Figure II illustrates this condition. The patient was a tall, heavily built man who fell into a corn bin ten years ago. He is unable to attend to his garden for any length of time without getting pain in his back. Urinary calculus was suspected, but not found.

In this connexion Dr. Goulesbrough's work at St. Thomas's Hospital in 1913 deserves mention. One hundred and ninety-six patients in whom the presence of urinary calculus was suspected, were



FIGURE V.  
Specimen illustrating atlanto-axoid dislocation—  
postero-anterior view.



FIGURE VI.  
Specimen illustrating atlanto-axoid dislocation—  
view from above. Odontoid process fractured  
and displaced forward.

sent to the X ray department. He found calculi in 9.7% and osteo-arthritis of the spine in 8.7%. Here is a case of spondylitis in which the appearances are strongly suggestive of a traumatism in the past.

To go to the other extreme in the matter of spinal injuries, atlanto-axoid dislocation may be mentioned. Figure III shows that condition in a man who came to the department a few weeks ago. He is a tall, microcephalic imbecile twenty-four years old. Six weeks before an X ray examination was made he fell forward, striking his head on a post and then on the ground. He had always walked with his head down and for some time his people did not suspect an injury. But on several occasions his brother had slapped him on the side of the head with the result that he fell to the ground and "twitched all over." The kyphosis and a projection just below the occiput led to his being sent for examination. The illustrations demonstrate the condition. So far there is no evidence of injury to the spinal cord. He is unable to express painful sensations.

#### TREATMENT OF BOCKHART'S IMPETIGO IN THE ADULT SCALP BY X RAYS.

By W. R. STOWE, M.R.C.S.,  
Palmerston North.

BOCKHART's impetigo is fairly common in children, but after a prolonged search in the literature, including the proceedings of the Dermatological Section of the Royal Society of Medicine published since 1908, I have been unable to find any reference to its occurrence in the adult.

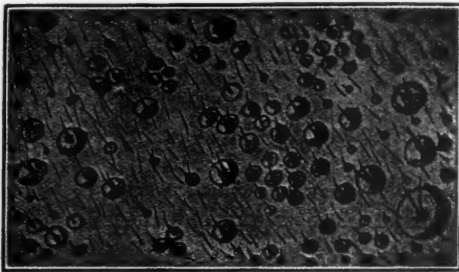


FIGURE 1.  
Bockhart's Impetigo, semi-diagrammatic.  
Sabouraud's "Topographical Dermatology."

The disease is characterized by the following appearances: The vesicles are one to two millimetres in diameter through which one, two or three hairs protrude. Pink at first, their contents assume a dark red hue and after rupture the serous exudate dries yellow. The exciting organism is the *Staphylococcus aureus*.

The case upon which this paper is based, was as following: The scalp of a healthy woman, forty years old, became infected eight years ago. Ever since she has been afflicted with irritation and vermication to an almost intolerable degree. Scattered over the entire scalp were innumerable lesions of the type already described. The vitality of the hair was not impaired so far as could be seen, nor were any roots loose in their follicles.

On the strength of unvarying success with irradiation in cases of *sycosis barbae* and *tinea tonsurans*, its applicability to this case was considered. In the absence of any record or personal experience of epilation in an adult of forty, it was decided to give the ultra-violet wave lengths a trial. A powerful tungsten arc was used. Applications were made every other day, with the result that the superficial lesions disappeared and remained in abeyance. However, when the interval was increased to five days, the vesicles reappeared. Obviously the disease was deep seated and so beyond the reach of the ultra-violet wave lengths. Hair roots in the scalp are from two to three millimetres long. The ultra-violet wave lengths will not penetrate more than one millimetre of skin. There was nothing for it but epilation of the entire scalp. An area five centimetres in diameter on each side of the vertex was irradiated. One was given a full epilation dose, another area three-quarters of this dose; this latter was used because in our experience hair is more easily epilated when it is diseased than when it is healthy. In due time all the hair in the first area and all the infected hair and some more not obviously diseased in the second area fell out. During the following six weeks the ultra-violet arc was applied at regular intervals with the purpose of keeping the surface of the skin free from bacteria. The new hair began to grow, so we at once proceeded to epilate the rest of the scalp, both irradiated areas being carefully protected. The result was entirely satisfactory. A few follicles in the vicinity of the vertex showed signs of renewed

activity, but electrolysis with a platinum needle in some cases and subepilation doses of X rays in others cleared them up. The hair is now growing vigorously and there are no signs of disease.

#### A CASE OF DIABETES INSIPIDUS ASSOCIATED WITH DEFECTS IN THE SKULL.

By W. R. STOWE, M.R.C.S.,  
Palmerston North.

DIABETES INSIPIDUS associated with defects in the skull is a very rare condition. There are but three cases (in children) recorded in the literature.

In October, 1925, a half caste boy (Maori) was brought for X ray examination of the skull.

The skiagram revealed multiple deficiencies of a punched out circular character in nearly all parts, more particularly in the anterior half of the skull, including the facial bones.

The clinical picture was *diabetes insipidus* with exophthalmos. The condition was diagnosed as one of dyspituitarism. This diagnosis was based on a paper in *The Medical Clinics of North America* (1920) entitled "Defects in Membranous Bones Associated with Dyspituitarism." The writer was Dr. H. A. Christian. His patient was a four years old child who presented the syndrome of *diabetes insipidus*, gross and extensive changes in the skull and exophthalmos. The exophthalmos was considered to be due to deficiencies in the orbital bones and transmission of pressure through them.

In April, 1926, Schüller (Vienna) read a paper entitled "Dysostosis Hypophysaria" at the International Radiological Congress. He described two cases in a girl of four years and a boy of sixteen years. He quoted two others. One reported by Hochstetter was that of a man, thirty-eight years old, with the typical signs and symptoms. At the *post mortem* examination the pituitary gland was found to be atrophic and sclerosed. Sclerosis of the other endocrine glands was also present.

The other case reported by Giberti was as follows: A man, twenty years of age, was affected by the

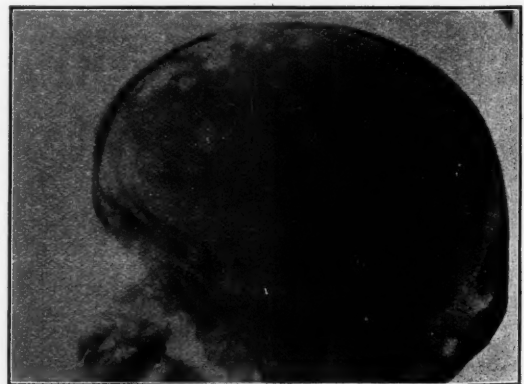


FIGURE 1.—Skiagram of multiple deficiencies of the skull; author's case.



FIGURE II.—Skiagram of multiple deficiencies of the skull; author's case.

typical syndrome. There were changes in the *os pubis* and femur. His growth had ceased at the age of thirteen.

In Holmes and Ruggle's "Roentgen Interpretation" there is a skiagram of a skull showing almost exactly the same deficiencies. It is labelled metastatic sarcoma. This diagnosis, in the light of the cases already described, appeared to us to be open to criticism and a letter to that effect was sent to Dr. Holmes. His reply was: "After a *post mortem* there was considerable discussion by the pathologists as to the exact nature of the tumour, but there was no question about its being a malignant metastatic one. The final diagnosis made by our pathologist, Dr. Homer Wright, was neuroblastoma." It has been described in Ewing's book as neuro-cytoma.

It is interesting to speculate on the cause of this condition. It may be said to bear the impress of a disease rather than that of a purely developmental anomaly.

The assumption is justified on the following grounds. (i) *Diabetes insipidus* is sometimes asso-



FIGURE III.—Skiagram of skull showing bone defects; lateral view; Christian's case.

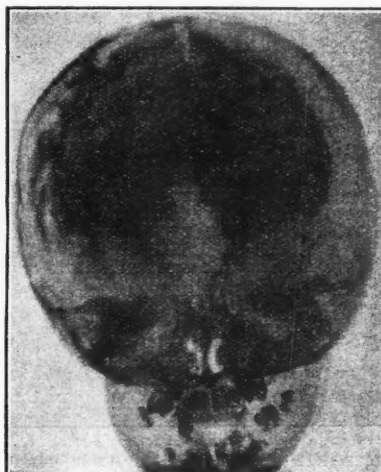


FIGURE IV.—Skiagram of skull showing bone defects; lateral view; Christian's case.

ciated with meningeal gummata. In 1916 Dr. Langmead described three cases of hypopituitarism associated with congenital syphilis; (ii) *diabetes insipidus* is hereditary in some families.

With regard to the skull defects the following quotations from the literature are *à propos*.

1. Menninger (*Radiology*, June, 1925) records a condition of heredo-syphilitic cranial osteo-porosis with honeycombing of the cranial vault, especially frontal bone.

2. Skinner in 1911 described *osteomyelitis syphilitica* with osteo-porotic changes in calvarium and irregular lace work appearance.

3. Schüller in 1912 stated that luetic disease shows a well known predilection for the facial bones and cranial vault.



FIGURE V.—Front view of head, showing prominence of eyes; Christian's patient.



FIGURE VI.—Lateral view of head showing prominence of eyes; Christian's patient.

4. Charles Dennie in 1925 described nineteen cases of osteoporosis in the calvarium; in ten of them no Wassermann reaction was obtained with the blood serum of the patient, his parents or family.

In the matter of the Wassermann test it has been recorded from the Bellevue Hospital, New York, that no reaction was obtained with the blood serum of 31% to 56% of patients with characteristic syphilitic lesions after death.

5. Huttenil has written: "Endocrine disorders of luetic origin in one generation lead to dystrophies in the next, but syphilitic infection not transmitted as well."

6. At the French National League against Venereal Disease (*The Lancet*, November, 1925) M. Leredde opened with the assertion that alongside well established cases of congenital syphilis with well developed symptoms and signs and positive serum reactions, there existed much more frequent forms in which the diagnosis was by presumption. Such presumption was permissible if there existed any congenital malformation or maldevelopment or any chronic malady in an infant the cause of which could not be ascertained, any history in any rela-

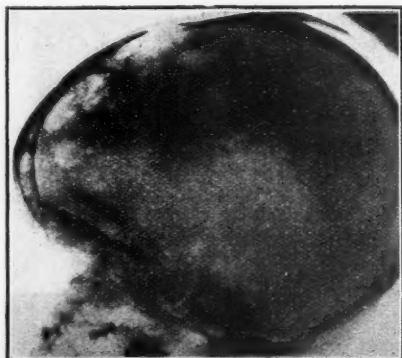


FIGURE VII.—Skiagram of skull showing metastatic sarcoma in a child (from Holmes and Ruggles; "Roentgen Interpretation.")

tives of any disease which might possibly be caused by syphilitic infection, any familial infection and certain varying changes in the blood and cerebro-spinal fluid.

The indication is that the skull should be examined by X rays in all cases of *diabetes insipidus* in children.

DR. S. S. ARGYLE (Melbourne) stated that he had seen one or two similar patients with osteoporosis in whom mental symptoms had been definite. Although there had been no polyuria, it was probably luetic in origin. With regard to the spinal case of spondylitis, in his experience this was fairly common without a history of trauma.

DR. NEIL GUTHRIE (Christchurch) stated that he had seen a case of *spondylitis deformans* both bilateral and localized. At *post mortem* examination a chronic tuberculous abscess had been found involving the intervertebral disc with no collapse of the body of the vertebra and there was an abscess in each buttock.

#### Radiological Problems.

He showed a male patient aged forty-three years, who had had a subcutaneous tumour below the left clavicle, a lympho-sarcoma. Similar tumours had appeared from time to time, but had been dispersed by X ray treatment. He produced skiagrams revealing metastases in the fibula, femur and skull. These were treated with 130 kilovolt and four millimetre skin dose. The sacro-iliac region had been involved and had been treated with 200 kilovolt deep therapy. The patient had become perfectly well and was carrying on his occupation.

He showed two patients with tuberculous lesions beginning in interarticular facets and a skiagram of a fetus *in utero* which was supposed to be that of a four months' pregnancy.

DR. W. R. STOWE (Palmerston North) asked for an opinion on a skiagram which he had reported on as a calcified hydatid cyst of the spine involving the body of the first lumbar vertebra. This report was confirmed by those present as being the most likely diagnosis.

### MONDAY MORNING, FEBRUARY 7, 1927.

#### COMBINED MEETING.—SECTION I AND V.

##### MAORI DIET.

By P. H. BUCK, M.D., Ch.B. (New Zealand),  
Wellington, New Zealand.

##### Historical.

ACCORDING to Maori tradition, New Zealand was discovered in approximately the year 950 A.D., by Kupe who came from Tahiti in Eastern Polynesia—the near Hawaiki of Maori tradition. Kupe returned to Tahiti without leaving any settlers in the land of his discovery. Some time after his departure, a drift migration came from some island in the west. They have been referred to as the *maru-iwi* from the name of one of their chiefs, but a more suitable term is to allude to them as the Pre-Toi people. In 1150 A.D., Toi came from Tahiti and was shortly followed by his grandson, Whatonga. In 1350 came the great colonizing migration from Tahiti, Raiatea and probably other islands of the Cook and Society group. This last migration brought cultivable food plants, such as the *kumara* or sweet potato (*Ipomoea batatas*), the *taro* (*Colocasia antiquorum*), the yam



(*Dioscorea* sp.) and the gourd (*Lagimaria vulgaris*). A species of a dog and a rat were also introduced into the country.

Thus before the year 1350 the inhabitants of New Zealand were in the food gathering stage of culture. They had to depend entirely on the indigenous products of the country. In this period there were no cultivable food plants. There were no mammals except two species of rats which were not numerous enough to assist in solving the food problem.

The food producing stage of culture rendered possible by the introduction of cultivable food plants had its limitations. This was due to the fact that the plants were of tropical origin. They did not thrive so well in the colder climate of New Zealand. They necessitated more care and labour in their cultivation and they grew only in favoured localities. Thus the *kumara* grew well in the warmer climate of the North Auckland Peninsula and in the Bay of Plenty and Taranaki districts. In these parts it supported a dense population as shown by the great number of terraced hill tops that denote fortified villages. Though found as far south as Banks Peninsula, it was not prolific throughout this area. In the Urewera district and parts of the Wellington Province it did not grow at all.

The *taro* had its southern limits about Cook Straits. It necessitated special preparation of the soil and in some parts was more in the nature of a luxury than a staple article of diet.

The yam was seen by Sir Joseph Banks as far south as Tolago Bay. It disappeared on the European introduction of the potato and its ancient name of *uchi* was transferred to an early variety of potato.

The gourd was used more as water vessels and receptacles, but the immature young form was used as a vegetable.

#### Meat Foods.

##### Mammalian Foods.

The country provided no indigenous mammals as a staple food. Occasional whales came ashore and these were not allowed to be wasted. In the South Island seals were obtained and black fish were utilized on occasions when they were stranded. Dog's flesh was the luxury of chiefs. Rats were preserved in their own fat and were a delicacy. There was, however, one land mammal that was eaten, namely man himself. Anthropophagy occurred in New Zealand as well as in other parts of Polynesia. The products of the numerous battlefields were not allowed to be wasted. Man was eaten not merely as a sacrifice or for ceremonial purposes, but as a physiological need in the absence of beef, mutton and pork. It should be noted, however, that with most tribes, the eating of human flesh was interdicted to women.

##### Fish.

Fish and shell fish formed the staple food supply of the Maori. The main settlements were thus situated along the sea coasts or in river and lake districts where supplies of fresh water fish were procurable. The seasons, habits and feeding grounds of fish were studied and the information utilized in

procuring them by traps, nets and hook and line. Large quantities were secured in their proper seasons, not only for immediate use, but for preserving by drying as a reserve stock. The snapper which is perhaps the commonest fish, was eaten raw on occasion. So also was the sea crayfish after soaking in fresh water for two or three days. Various species of shark, which seem rich in ammonia, were dried and esteemed as food. Besides such fish as the snapper, *kahawai*, barracouta and others, the whitebait were preserved by drying or cooking and stored as a reserve. The sea crayfish were also preserved.

Of fresh water fish, the eel was a prolific source of food supply. They were caught not only by hand, bobs and eel baskets throughout the year, but the migrating eels that pass out to sea in March and April were caught in huge quantities and dried as a reserve stock. As an example of the quantity of eels that exist in our rivers, I may mention that a fortnight ago my own tribe went to the Uruti River in North Taranaki to secure eels as part of the provisions for the gathering of Maoris about to be held at Waitara in connexion with a Royal Commission set up to inquire into the confiscated lands of the west. The method of catching was the worm bob and they were prepared to camp out a couple of nights. However, they secured three hundred large eels in less than two hours and returned as they could not carry any more away. From this it will be observed what an important factor the eel was as a source of Maori food supply. Rivers, swamps and lagoons in both islands simply teemed with them. In the larger lakes such as Rotorua and Taupo, the fry of some of the fresh water fish were caught in a wire net, adult forms, the fresh water mussel and fresh water crayfish were caught in large quantities and helped to make these regions habitable.

##### Shell Fish.

Every form of shell fish available on reefs, sea beaches and river estuaries was eaten. The shell middens along the coasts and even at some distance from the coast prove what large quantities were consumed. Mussels, cockles and bivalves were largely eaten raw. They could be easily opened with another shell. Even at the present day, mussels and cockles are served raw at Maori gatherings as an alternative. They were eaten on the shell and the liquid contained was always supped up with the fish. Univalves of the turbo species were cooked to render extraction of the fish easier. The *paua* (*Haliotis*) were more often eaten raw than cooked. Even when bivalves were cooked, they were never cooked hard and dry as is the custom with Europeans. Here the contained liquid within the shell was always supped up before the fish was detached. Echinoderms were considered a delicacy and were usually eaten raw, not only the fleshy parts, but also the contained seaweed on which they fed. The various bivalves and the *haliotis* were also preserved by cooking, stringing on a strip of flax and sun drying. They became very hard, but kept well as

reserve provisions that were specially useful on long marches.

So important were the various species of shell fish as a food supply that the shell fish grounds were carefully preserved and closed seasons declared if there was a danger of the grounds becoming depleted.

#### Fowl.

Every kind of bird was eaten except perhaps the hawk and the shag. The principal birds eaten were the wood pigeon, the parrot and the *tui*. These birds were obtained in large quantities during the proper winter season when they were fat after feeding on the berries of the *hinau* and the *miro*. They were merely plucked. The contained organs and entrails were cooked with the bird and eaten. There is no doubt as to the superiority of the flavour of the birds cooked with the entrails *in situ*. They were secured by spearing, snaring and the use of decoys. The lack of projectile weapons was no handicap.

Organized expeditions were made into the forests during the winter season to secure a reserve supply of preserved pigeons. The bones were removed and the birds grilled before a fire. The fat dripped down into wooden troughs. The birds were then packed in receptacles made from calabashes or totara bark and the melted fat poured over them. They were then termed *huahua* and would keep for a year. Ducks and godwit were snared and in the southern end of the South Island, the young of the mutton bird were secured in large numbers and preserved in kelp kegs.

Though Maori tradition says little about the *moa*, excavations near the Shag River and other parts of the South Island prove that various species of this extinct bird were consumed by early people who were of Polynesian extraction.

#### Vegetable Foods.

##### Cultivable food plants

Mention has been made of the *kumara*, *taro*, yam and gourd. Attention has been drawn to the importance of the last as a food and the limited distribution of the other three. Of the three, the *kumara* was the most important. It was carefully handled and stored in underground pits and earth covered houses. The *taro* entailed considerable care and labour in cultivation. It was carefully doled out for the use of visitors and was alluded to as: "*Nga kai tatau a Whaetiri*" (the counted food of Whaetiri). Of the yam we hear little and its still more limited distribution makes it of little general importance.

##### Indigenous Plants.

*Pteris aquilina* var. *esculenta*.—In spite of the *kumara*, the common source of carbohydrates was the rhizome of the New Zealand bracken *Pteris aquilina*. There are many sayings and proverbs praising its qualities and denoting its importance. One of these—*te tutanga te unuhia*—states that as a staple it cannot be displaced. The rhizome of plants which had grown undisturbed for about five years after a

burning off were dug up with a pointed stick, cut into lengths of about ten to twelve inches and stacked up to dry. The shorter broken bits were used first and the others tied in bundles and stored. When used the rhizome was cooked over live embers, beaten with a wooden beater to remove the outer hard skin and to loosen up the edible parts between the stringy vascular bundles. It was then chewed, the starchy matter being swallowed and the fibrous material rejected. In some cases, the starchy material was extracted in a bowl of water, allowed to settle and the water discarded. A kind of cake known as a *pepe aruhe* was made and cooked. This however, was a special preparation made for chiefs or used on expeditions. The common method was that described above.

*Condylines*.—The underground stems of various species of condylines were cooked in earth ovens, dried and stored for use. The stem is very fibrous, but contained a starchy saccharine material that was extracted by chewing.

*Cyathea medullaris* (*mamaku*).—The pith of this species of tree fern was cooked in the earth oven and largely used in ancient times in bush country.

*Typha angustifolia* (*raupo*).—The roots of this water plant were dug up in times of dearth and eaten. A bread was also made from the pollen.

*Marattia praxinea* (*paratawhiti*).—The horseshoe shaped bulb of this fern was cooked and eaten, but it had a limited distribution in the North Island.

*Gastrodia Cunninghami* (*perei*).—The bulb of this orchid, according to Best, was eaten in the Urewera district.

#### Green Vegetables.

The Maori was badly off for green vegetables as regards variety. There was none cultivated except the inner green leaves of the *taro* which was primarily cultivated for its bulb as a root crop. The tops were cooked as a green vegetable. The other vegetables were from herbs or trees that grew wild.

*Sonchus* (*puha*).—The vegetable in most demand was the common sow thistle or *Sonchus oleraceus*. Cheeseman in his work on the flora of New Zealand states that there is a doubt as to its being indigenous. There are, however, two other species which are undoubtedly indigenous and all come under the Maori term of *puha* or *pucha*. This herb has no heart and the leaves are thin and green. It is slightly bitter.

*Solanum nigrum* (*poroporo* or *raupeti*).—This herb according to Cheeseman is indigenous. It has a tender thin green leaf and makes an excellent vegetable.

*Aspidium Richardi* (*pikopiko* or *mauku*).—The young curling fronds of this fern are cooked in bush regions where the plant is plentiful.

*Cordyline* (*ti*).—The inner bulb of young leaves at the base of the leaf heads of the *Cordyline australis* and other species of cordyline were cooked as a vegetable. It is somewhat bitter, but the bitterness may be removed by soaking in running water. It was looked upon as a good tonic.

*Rhopalostylis sapida* (nikau).—The unexpanded young leaves of the nikau palm were also used as a green vegetable.

*Coprosoma* sp. (?) (raurekau).—The leaves of the large leafed coprosoma known to the Maoris were wrapped round eels and cooked with them. The fat of the eels soaked into the leaves and the leaves were eaten with the eels.

*Parengo* or *karengo*.—This is a thin leafed green seaweed which grows plentifully along the coasts of both Islands. It was much used as a vegetable. It could be dried and was then much in demand by inland tribes. Some was sent by us to France during the war and was much appreciated. All the above are still used except perhaps the nikau, but the commonest and most in favour are the *puha*, *poroporo* and *parengo*. If the greener and the thinner the leaf the better the vegetable, then both the *puha* and the *poroporo* are perfect vegetables. They grow up plentifully as weeds in cultivations and gardens, but the European roots them out to grow thick leafed cabbages with a big heart.

#### Fruits and Berries.

New Zealand was badly off in pre-European days as regards fruit. The fruit of the *Solanum navi-culare* (also called *poroporo* by the Maori) was eaten by children and adults on occasion. So also was the yellow outer part of the *Carynocarpus laevigata* (*karaka*). The fleshy bracts of the flowers of the *Freycinetia Banksii* (*kiekie*) were eaten as was also the ripe fruit. Smaller berries of the *Fuchsia ex-corticata* (*Konini*), the *Podocarpus dactyloides* (white pine, *kahikatea*), *Alectryon excelsum* (*titoki*), *Piper excelsum* (*kawakawa*) and other trees were eaten when ripe. They probably served a useful purpose, but the time they were available was very short. There was no method of storing or preserving these berries and they cannot be considered seriously as forming any vital part of the diet of the Maori.

The juice of the berries of the *Coriaria ruscifolia* (*tutu*) was also expressed and used as a beverage or a flavouring agent, but its season was also short.

There were, however, three berries that were important as eking out and adding variety to Maori diet.

1. *Corynocarpus laevigata* (*karaka*).—Mention has been made above that the only ripe part of the berry of this tree was eaten, but it was the inner kernel that formed a useful food supply. The ripe berries were collected and cooked in an earth oven for twenty-four hours. This destroyed a ferment that otherwise acted on an alkaloid named *karakine* by Professor Easterfield who isolated it, and liberated a poison that caused paralysis. The cooked berries were then soaked in water and would keep for some time.

2. *Beilschmiedia tawa* (*tawa*).—The berry of the *tawa* contains a kernel which was gathered in quantity and cooked on the embers or in the earth oven.

3. *Elaeocarpus dentatus* (*hinau*).—The raw berries were pounded in a wooden vessel, the hard stones

removed and the berry pulp made up into cakes which were cooked in the steam oven. This food was greatly esteemed.

The *karaka* grew along the coast and the *tawa* and *hinau* inland in the forests. Thus their respective importance varied with the region in which people lived.

#### Cooking of Food.

The common method of cooking was by the earth oven, *umu*. Firewood was stacked in a shallow pit in a particular manner and stones about the size of a clenched fist were evenly placed above. The fire was lit and when it burned down the stones were sufficiently heated. The unburnt pieces of wood were removed and the stones evenly spread over the bottom of the pit. A little water was sprinkled over the stones. The flesh foods were placed upon the stones, then the vegetables such as *kumara* or *taro* above and the green vegetables last of all. A little more water was sprinkled over the food and plaited mats quickly covered over. Then the steam was sealed in by a covering of earth over all. The food was thus steam cooked and the flavour was excellent.

Grilling in the embers was used with fern root and sometimes with fish or shell fish. Birds and fish were also spitted and cooked in front of the fire.

Cooking by dropping heated stones into a wooden vessel containing water was sometimes used, such as making a gruel with the starchy material obtained from the cordylines.

#### Meals.

The general rule was two meals a day. The first meal was in the morning and the second in the late afternoon when the day's work was done. In times of dearth, supplies often admitted of only one meal. At festivals, feasts and gatherings, the Maori ate as often as his hosts would allow and as much as his capacity was capable of.

#### Variety of Diet.

One of the problems that continually faced the Maori householder was the balancing of the diet sheet. Some form of flesh food had to be provided to go with the carbohydrate. Hence the stocking of the special store house with preserved pigeon and dried fish and shell fish. The root crop or fern root had to have a *kinaki* of flesh. To obtain variety of food, ceremonial gifts of food were often given. Thus a sea coast tribe often sent the products of their district, such as dried fish or shell fish, inland to another tribe as a present. The inland tribe bided their time and returned the gift with one of preserved pigeons or dried eels. Thus the gifts were often in the nature of camouflaged barter. Inland people often visited the coast to get a change of diet. Certain foods were recognized as the right complement or *kinaki* of each other. Such are dried shark and the cooked kernel of the *karaka* berry.

#### Beverages.

The Maori had only one beverage, water. They had no form of alcohol. Of water they drank a



large quantity. In the meeting houses water is always taken round at fairly frequent intervals.

#### Nature of Foods.

Fresh foods and vegetables cooked in the earth oven were very tender. There was, however, a good deal of hard food consumed, such as dried shell fish, preserved fish and preserved pigeons. *Kao* or dried cooked sweet potato was also very hard. The fern rhizome and the underground stem of the cordyline contain much fibrous material.

#### Chewing.

In spite of the introduction of cultivable food plants, the pre-European Maori had to do a considerable amount of chewing, much more so than the present-day European. Besides the hard foods mentioned above, he used masticatories from the milky substance of the sow-thistle, the gums of various trees and bitumen. He liked chewing. The chewing of hard and fibrous foods is shown by the marked attrition of the teeth of Maori skulls of the pre-European period. Scott<sup>(1)</sup> drew attention to the dislocation of the first molar of the upper jaw and the oblique wearing on the outer side of the tooth. This is to be seen also on the lower jaw. Professor Pickerill has noted that this dislocation is always associated with an alveolar abscess. The final factor in the dislocation would seem to be the pressure from without inwards as the fern rhizome is being chewed.<sup>(2)</sup> The length of rhizome is not cut or bitten off, but is fed in transversely between the two first molars.

#### Summary.

No attempt is made in this paper to give the food values of the various foods used. In most cases these have yet to be worked out in a scientific laboratory. The following facts, however, stand out.

1. The coastal regions were the most occupied because of the marine food supply. A large amount of marine food was eaten, fish, shell fish and seaweed.

2. The greater part of the shell fish supplies were eaten raw. Every part was eaten even in the haliotis and echidna. The contained liquid was drunk. Snapper and on occasion other fish and the sea crayfish were eaten raw. In the crayfish every part was eaten except the thin alimentary tract.

3. Shell fish cooked for immediate use were never cooked hard and dry. They were left on the embers until the bivalve showed the slightest opening. The contained liquid was drunk.

4. Inland tribes often came down to the sea coast to picnic on fish and shell fish. Continual barter went on for preserved fish and dried seaweed.

5. The eel was one of the staple articles of diet especially with up river tribes.

6. With pigeons, parrot, *tui* and godwit, all the internal organs including the entrails were eaten. As little as possible was wasted of any food.

7. Green vegetables as a *pūha* were always sought after to add to the root and flesh foods. The two commonest, the sow-thistle and the *solanum nigrum*

with their thin green leaves, give the requirements of the perfect green vegetable.

8. In the earth oven, the steam was kept in by the sealing with earth. Casserole cooking is the nearest approach to it. There was no subjecting of vegetables to combined boiling in a large quantity of water which was afterwards thrown away.

8. More chewing was necessitated by the harder dried foods and the staple fern root. Between meals, masticatories were greatly in use.

10. There were two meals a day.

11. Fresh spring or stream and river water was the only beverage.

#### Conclusion.

On the diet described the pre-European Maori maintained a magnificent physique. He is counted amongst the tall races of the world and the muscular development of the lower limbs was second to no other race in the world. He possessed physical energy and endurance to a very high standard and he excelled in athletic exercises and in hand to hand encounters. In considering the relationship of diet to the health and physique of the Maori, the other part of the ethnological food complex must not be forgotten. The Maori procured his foods himself. He was hunter, fisherman and agriculturist in turn. He had to make his own implements. In the strenuous quest for food he was constantly in the open air. He was in constant physical training for labour and for war. These factors cannot be divorced from diet in their effect on health and physique. There is an old Maori saying against coming to hasty conclusions based on three articles of diet:

If you drink the juice of the *tutu* whilst it is warm, you go mad.

If you eat the kernel of the *karaka* before it is cooked, you will become paralysed.

If you eat the flesh of the herring too quickly, you will be choked by a bone,

For that was the fish which killed Tamarereti.

#### References.

- <sup>(1)</sup> J. H. Scott: *Transactions of the New Zealand Institution*, 1893, Volume XXVI, page 22.
- <sup>(2)</sup> P. H. Buck: *New Zealand Dental Journal*, May, 1925.

#### DIET AND NUTRITION IN NORTHERN MELANESIA.

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THERE are two common but erroneous ideas concerning the island peoples of the Pacific, the first that they lead an idyllic life of ease and plenty and the second that there is a mysterious automatic doom which of necessity must overtake them in the presence of a "higher race."

As a matter of fact the "idyllic life" of the native becomes on examination a miserable and primitive struggle for existence amidst all the myriad hardships incidental to savagery, while the further one

studies the admittedly enormous depopulation of the groups, the more obviously it is seen to result from definite, recognizable and often preventable causes.

In Northern Melanesia there has been for some time an excellent opportunity of investigating the conditions affecting decline of population.

Observers have usually held that the causative agents in this depopulation are among others epidemics, altered sociological conditions and psychological factors; doubtless these are most important. While it is impossible in a paper as short as this to deal with each of these related complex causes, there is, however, one outstanding matter to which little reference has been made. This is the relationship between the low resistance of the native to diseases and the faulty nature of his diet. The writer is strongly of the opinion that the one is largely the sequel of the other.

Until a few years ago attention was largely concentrated on the bulk of a diet in calories and it was thought that if a total value of 3,000 calories was provided, the diet was necessarily satisfactory. Further investigation showed that there must be also a proper balance between the protein, carbohydrate and fat constituents and many diets were laid down which aimed at perfection in this regard. Perfection, however, was not to be thus easily attained.

Puzzling variations in results indicated some other unidentified factor and science first assumed that results varied with the mineral salts contained. The careful experiments of McCollum and Davis, followed almost immediately in 1913 by Osborne and Mendel, demonstrated the presence of certain unidentified dietary essentials which were called "vitamins" and it was soon found that these vitamins existing as they did in most minute quantities in adequate diets, were nevertheless the final criteria of suitability.

It becomes more and more obvious there are several of these accessory food factors which have not, as yet, been discovered, while at least four have been so far investigated as to be established as definite.

These are known as "fat soluble A," "fat soluble D," "water soluble B" and "water soluble C" respectively.

The absence of these accessory dietary essentials results in definite disorders, among which may be mentioned rickets, scurvy, beri-beri and failure of growth. These are well recognized conditions.

More significant, however, than these spectacular forms of malnutrition and more destructive of human happiness and efficiency are those insidious effects of faulty diet, where no actual disease arises, but where the whole future of the individual is deleteriously affected.

McCollum and Simmonds<sup>(1)</sup> have produced some extraordinary results by experimental work on rats and have demonstrated the applicability of their results to the human subject. It has been found possible, for example, in their series to promote growth and development in rats for a considerable

period on an unsuitable diet (such is the impetus to growth and so great are the recuperative powers).

Moreover, there is nothing in the appearance of these rats to indicate that they are in any way deficient, but if the diet is persisted in, it has been found that it profoundly affects their fertility, the mortality among their offspring and their individual spans of life.

Rats fed on diets varying in suitability, but all more or less deficient, can by this means be brought into a condition of controlled senility, with the production of sudden age and failure of strength and weight, according to a regular graded scale. Thus they may be made to age and die by simple persistence in diets varying in unsuitability at three to four months, seven to eight months, fifteen months, twenty months or twenty-five months and so on.

The symptoms of approaching death in all cases are roughness of coat, partial loss of hair, increased somnolence and increased irritability; the actual cause of death is almost always lung disease.

McCollum sums up his results by stating:

The rate at which senile characters develop, is directly and to a remarkable degree influenced by faults in the diet, of degrees of magnitude which are too small to make themselves manifest during youth or to interfere seriously with growth.

McCollum points out, moreover, that while the reaction of very young and immature animals is certainly unduly severe, the nutritional requirements of adult life are, contrary to general belief, almost as exacting as those of the years of growth.

Whenever, too, a food-deficient individual is forced to face a debilitating factor, his hidden defect suddenly shows itself like a rottenness in his body fabric and, as McCollum says, he then falls a "prey to influences which a more robust constitution would be able to tolerate and overcome."

Applied to the human individual in the persons of the natives of New Guinea these findings have a striking import; for it would seem that long-continued food deficiencies might explain precisely that lack of resistance to disease which is so evident a characteristic of the race.

The question naturally arises: Do the natives of Northern Melanesia use a diet which is unsuitable?

The answer must certainly be in the affirmative.

It may be taken for granted that the normal healthy native requires approximately 3,000 calories daily, provided by one hundred and fifty grammes of protein, five hundred grammes of carbohydrate and fifty grammes of fat and that there must also be present adequate quantities of mineral salts and accessory food factors (vitamins).

Excluding indentured labourers, who often live on a diet totally unsuitable and even dangerous, the diet of the native even in his own village is essentially faulty according to this standard.

It consists very largely of carbohydrates and amongst growing children (especially girls) entirely of carbohydrates if we except certain edible native leaves.

The roots and tubers which comprise the diet contain some 15% of irritating fibre; they are bulky, a

poorly nutritious, grossly deficient in protein and fat and also in vitamins A and C, as will be seen by a later analysis.

The native has certain instinctive cravings for the foods which he requires, and he evidences the common faults of his average diet by the avidity with which he seeks the compensating influences present in meat, glandular tissues, fat (both vegetable and animal), edible leaves and fresh fruits.

The first great deficiency in his diet is in the proportion of animal protein and the whole attitude of the native to life is affected by it.

Castellani and Chalmers,<sup>(2)</sup> referring to the excellent work of McCay<sup>(3)</sup> on the importance of the protein factor, state:

McCay has shown that when the protein standard of a tropical dietary is very low then the physique, the capacity for work, the health and the resistance against disease are also lowered and he has illustrated these facts by reference to the rice-eating Bengali. Moreover, he has answered his critics in a most able manner and has demonstrated by comparing closely allied tribes living under identical conditions of climate, solar irradiation, sexual excesses, early marriage *et cetera*, that it is the influence exerted by the food and particularly by the proteins of the food that is of importance in determining the degree of muscular power, the general physical endowment, the powers of endurance, the resistance to disease and, most important of all, the place which a tribe or race has won for itself in manliness, courage and soldierly instincts.

The excess carbohydrate eater is the hewer of wood and the drawer of water for the more vigorous races and lacks initiative and energy to be otherwise. The natives of Northern Melanesia may be essentially so described. They are protein starved and indeed their protein supplies are even now progressively diminishing in quantity and quality.

Apart altogether from cannibalism which until thirty years ago was exceedingly common and widespread, the evidence of missionaries and others indicates a progressive diminution in the number of native pigs available as food. The native is indeed becoming even more than before an excess carbohydrate eater and his animal protein moiety diminishes consistently.

A second most serious defect is the relative absence of fat, including as it does the absence of fat-soluble vitamins to a great extent.

The only fats obtained by natives in this territory are very small quantities of animal fat (this is often a monopoly of the old men of the tribe, forbidden to women and to youths) and vegetable fats such as those obtained from the coconut, native almond (*galip*) and so on. The presence of considerable sunlight wards off very probably some of the ill effects that would otherwise develop, but the ready predisposition to tuberculosis that is seen amongst natives in this locality and elsewhere in the Pacific, is in the opinion of the writer definitely affected by this dietetic deficiency, if indeed it be not a direct sequel.

Sir James Fowler referring to the subject of tuberculosis in the tropics,<sup>(4)</sup> attacks the generally accepted view that the relative immunity of the white man to tuberculosis as against the black man

is acquired by repeated unsuccessful infections at different age periods of the life of the individual; he refers it to an inherited racial resistance acquired by the contact of countless generations of his race with that disease. May not this "racial" resistance be largely a matter of sociological conditions and pre-eminently of food?

The experiments of McCollum would certainly seem to indicate such a possibility.

Though they are white men, the potato-eating Irish in Ireland with their great excess of carbohydrate, still fall as readily victims to tuberculosis as their forefathers have for generations.

Their death rate from tuberculosis is modified upon transference to countries like Australia and New Zealand, where the food supplies are richer and more adequate and the "racial" tendency to tuberculosis disappears.

A passing reference may be permitted here, perhaps, to the very great importance the question of diet, especially the use of materials rich in fat-soluble vitamins, is regaining at the present day as a factor in therapeutics. Butter fat and dairy products generally, egg yolk, cod liver oil, fats of glandular origin, green vegetables and other substances rich in vitamins may be quoted as examples.

To return to the subject of the native diet in Northern Melanesia, however, some consideration of the actual foodstuffs may be of value.

Native diets consist chiefly of *taro* (*dasheen*), *caladium colocasia*, which may be regarded as the most commonly esteemed staple, with banana, *kaukau* (sweet potato), *sak sak* (crude sago), tapioca, yam and the like as secondary foods. Edible native leaves are much used and salt where it is used is added by cooking in salt water. Fats are represented almost solely by coconut and native almonds (*galip*) or ground nuts. A small proportion of animal fat occurs in the diet of the men of importance in a village.

Fish (mostly white fleshed and poor in fat and vitamins), fowls, opossums, snakes and pigs form occasional additions, but these are only constant among the fortunate.

Inland the villagers get little protein of this kind and, moreover, are almost deprived of salt. Their poor development and physique evidence the fact, for of all the tribes those deprived of salt are the poorest, meanest and least advanced. In many places indeed the interior is wholly uninhabited for this reason.

Native instinct and experience select as the most valuable of available foods the *taro* and it is indeed so. The remainder have bulk for bulk considerably less value than *taro* has and experience again has led the native to the recognition of the fact that lengthy reliance on these watery stocks results in debility, lack of resistance to disease and a condition comparable to the "hunger oedema" of the textbooks.

If the native ideal food, the *taro*, be considered and analysed, it will be found to be grossly deficient in the particulars mentioned above.

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Thus figures obtained by investigators in the Philippine Islands and elsewhere give the following food properties for this root:

Constituent.	Food.	
	<i>Taro</i> (whole).	<i>Caladium</i> <i>colocasia</i> (peeled).
Protein .. .. .	1.29	1.16
Carbohydrates .. .. .	33.51	39.17
Fat .. .. .	0.39	0.12
Water .. .. .	63.21	58.35
Ash .. .. .	1.01	0.69
Fibre .. .. .	1.59	0.51
Peel .. .. .	10.7	..
Vitamin A .. .. .	Very low	
Vitamin B .. .. .	++	
Vitamin C .. .. .	0	

From these analyses it will be seen that *taro* is definitely deficient in protein and in fat, grossly so in vitamin A and quite lacks vitamin C. The further examination of native staples serves to emphasize the same deficiencies in a greater degree in the lesser esteemed foods.

It is, of course, true and obvious that these defects are partly or wholly balanced by the inclusion of protein and edible native leaves where these can be obtained, but it is desired to stress the fact that such balance is only attained irregularly.

The most commonly diminished factor is fat and it should be expected if the experimental work of recent years is well founded, that there should be a ready field for the implantation of tuberculosis among the Melanesians. This is so.

From the *post mortem* figures of Rabaul taken from autopsies performed on all labourers dying during their term of indenture, it is found that tuberculosis kills 25% and pneumonia 24%, while 24% die from bacillary dysentery. In other words, half of those who die, die from respiratory infections and half of the remainder from bowel infection.

While these figures are not truly representative of the population in the villages, they are sufficiently significant.

It may be said that the natives of New Guinea even in their villages have medium to poor physique, lowered capacity for continued work and lowered resistance to disease, especially to respiratory and intestinal infections. In fact, they reveal precisely those conditions which accompany dietetic deficiencies, while in conclusion examination of the diets in common use demonstrates just those deficiencies which might be expected.

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- <sup>(1)</sup> E. V. McCollum and N. Simmonds: "The Newer Knowledge of Nutrition," Second Edition.
- <sup>(2)</sup> A. Castellani and A. J. Chalmers: "Manual of Tropical Medicine," Third Edition, 1919, page 107.
- <sup>(3)</sup> —. McCay: *Indian Medical Gazette*, 1907, page 370; "Scientific Memoirs," Government of India, Nos. 34, 37 and 48.
- <sup>(4)</sup> J. N. Fowler: "Tuberculosis in the Tropics," extracts from a paper read before the International Conference on Health Problems in Tropical America, held at Kingston, Jamaica, July 22, 1924.

#### THE RELATION OF GASTRIC FUNCTION TO THE CHEMICAL COMPOSITION OF THE BLOOD: A PRELIMINARY REPORT.

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A CONSIDERATION of the literature concerning the function of the stomach under normal and pathological conditions viewed in the light of our own clinical and experimental work long ago led us to suspect that the chemistry of the blood has some relationship to gastric muscle function. As this in turn seems to have a direct bearing on dyspeptic symptoms, we determined to investigate this relationship and, if present, to find how far the alteration of blood chemistry could be utilized in the treatment of certain dyspeptic conditions.

The evidence we have mentioned seems to indicate that conditions in which the sodium bicarbonate of the blood plasma is increased, are associated with increased tonus and activity of gastro-intestinal muscle. Thus, the activity and tonus of intestine are increased in dogs by the intravenous injection of sodium bicarbonate (King and Church),<sup>(1)</sup> human gastric tonus and contractions are increased during sleep and in the early morning (Carlson)<sup>(2)</sup> at which times a raised blood bicarbonate is known to be present (Luckhardt,<sup>(3)</sup> Leathes<sup>(4)</sup>) and also as the bulk of the gastric contents diminishes (Hurst and Ryle<sup>(5)</sup>) when the same condition of the blood is present. Acidity during meals, which as a rule varies directly with gastric tonus, has been shown to be high in those persons who show a high alveolar carbon dioxide before meals (Bennett and Dodds<sup>(6)</sup>) which in turn varies with blood bicarbonate. Acidity is also increased after the intensive alkali treatment of Sippy's diet (Hardt and Rivers<sup>(7)</sup>). By direct experiment it has been proved that isolated plain muscle has a higher tonus when bathed in fluids of slightly more alkaline reaction than normal plasma and a lower tonus under the opposite conditions (Underhill<sup>(8)</sup>), while the electrical excitability of muscle is increased in conditions of alkalosis in the intact animal (Morris<sup>(9)</sup>). It seems probable that the blood condition in these persons really acts by producing a slight anoxæmia (Morris<sup>(9)</sup>) with the result that the blood glucose required by muscle cannot be readily utilized (Bulatao and Carlson<sup>(10)</sup>) and that, as the condition of increased tonus is that condition in which the least oxygen consumption occurs (Evans<sup>(11)</sup>), alkalosis therefore leads to this condition of hypertonicity.

On the other hand when blood bicarbonate is diminished we have a fall in tonus of gastric and other plain muscle or clinically the symptoms thereof. All those conditions associated with hyperpnœa and therefore a lowered alveolar carbon dioxide and blood bicarbonate, such as balloon and

mountain sickness,<sup>(12)</sup> fevers,<sup>(13)</sup> uræmia,<sup>(14)</sup> anæsthesia,<sup>(15)</sup> anæmias<sup>(16)</sup> and simple cardiac disturbances,<sup>(17)</sup> are known to have a hypotonic stomach and to suffer from nausea, anorexia and often vomiting. This is no doubt the cause of the severe anorexia noted in the Mount Everest Expedition (Somervell<sup>(18)</sup>), the vomiting and anorexia of uræmia and late diabetes and so forth. It is probable also that in some cases the bicarbonate of blood falls on account of its union with metabolic acids formed in the body in disease and infection, as for instance the low tone stomach and anorexia of the toxic out-patient of the public hospitals, in whom, as we shall show later, the plasma bicarbonate is low.

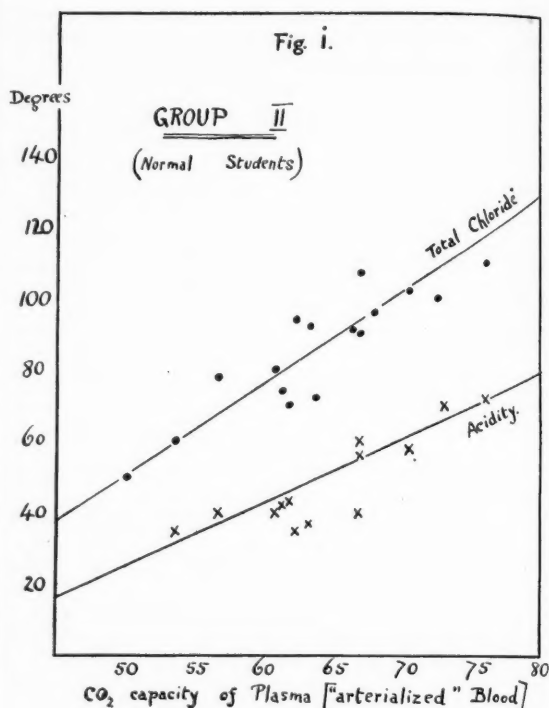
#### Experimental Work.

Several series of observations were made and abandoned until a method was evolved which gave results definitely correlated with the results of gastric examination.

Group I. of twenty-six individuals, all with gastric symptoms. In all the blood was drawn under oil from the fasting patient and the hydrogen ion concentration (Dale and Evans<sup>(19)</sup>), plasma bicarbonate (Van Slyke<sup>(20)</sup>) and plasma chloride (Myers<sup>(21)</sup>) were determined. An attempt to correlate these results with those of a fractional test meal given immediately after the blood was drawn, failed to disclose any relationship.

Group II. of twenty-seven healthy individuals, mostly students. It was noted in the previous group that it was impossible to draw blood from the veins of all without venous stasis, a condition which alters blood composition, or under exactly the same condition of stasis. In order to bring all samples of blood under exactly comparable conditions, we decided to equilibrate portion of each sample of blood with the alveolar air of one of us at room temperature, that is all samples of blood were treated with a mixture of oxygen and carbon dioxide of the same composition. The blood was then centrifuged under oil and the bicarbonate of plasma determined. The results (see Graph I.) show that the plasma bicarbonates vary directly as the total chloride of the test meals at one hour. The same holds good at thirty, forty-five and seventy-five minutes, but after that time other factors appear to destroy the relationship. Now it has been shown by the Guy's Hospital workers (Campbell and Conybeare<sup>(22)</sup>) and often noted by ourselves that acidity and total chloride at one hour vary roughly with gastric tonus, when several individuals are compared. Hence this graph indicates that gastric tonus varies with plasma bicarbonate. Graph I. also shows the same relationship with gastric acidity one hour after a test meal.

This relationship between acidity and total chlorides on the one hand with gastric tonus on the other can be deduced theoretically. Thus, the acidity of gastric contents at any moment, say one hour, is indicated by  $\frac{\text{total hydrochloric acid}}{\text{gastric volume}}$ , while the sodium chloride in the stomach (difference



between total chlorides and free hydrochloric acid) equals  $\frac{\text{volume of regurgitated duodenal fluids}}{\text{gastric volume}}$ , since

the sodium chloride comes from the duodenum as a result of neutralization of gastric acid there and partly as preformed sodium chloride secreted by duodenal glands. Now it will be seen that diminution of gastric volume is the only alteration of these factors that will raise both acidity and gastric sodium chloride and therefore total chloride as well. Alteration of no other single factor will produce these results. Hence those individuals who yield a high acidity and total chloride in the test meal at say one hour, compared with other individuals, must also have more rapidly emptying, active, hypertonic stomachs than the others. These are the people who also have, as shown in Graph I., high plasma bicarbonate.

In this group the observations of Group I. were repeated with the same results.

Group III., consisting of twenty-one individuals, the majority convalescents from surgical affections not of the stomach. In these there were estimated the bicarbonate and chloride contents of whole blood equilibrated with alveolar air and also of its corresponding "true" plasma. Although on the whole the chlorides of blood and plasma varied inversely as total chloride of test meal at one hour, the relationship was too indefinite. The plasma bicarbonate results are, however, shown in Graph II. Some of these patients had been examined by X rays and it was noted that all those who had hypotonus and

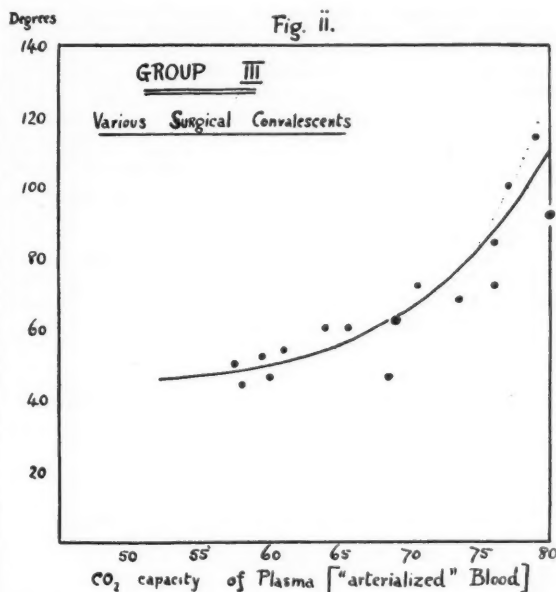
gastroptosis or who had a large residue of food two hours after the commencement of a fractional test meal, were grouped together at the lower end of the curve (Graph II.). This curve is lower than that of Graph I. owing to a different method of calculating results. Included in this group is a number of people who were examined by X rays with a barium meal and had the blood examinations made as already detailed. No test meals were given. Table I. reveals that all of these conditions which are characterized by ptosis and hypotonus of stomach and bowel, are associated with a low plasma bicarbonate and a high plasma chloride, that is a distinct acidosis though still within normal limits. It is unfortunate that we have not been able so far to obtain any cases of hypertonus as shown by skiagram.

TABLE I.

Person.		Plasma.		X Ray Report.
Number.	Age.	Bicarbonate (CO <sub>2</sub> ).	Chlorides.	
1	38	70	625	Hypotonic; small residue at six hours.
2	62	68	644	Hypotonic; ptosis; quarter residue.
3	27	66	670	Orthotonic; gastroptosis and colonic stasis; quarter residue.
4	32	65	617	Large ptosed stomach; quarter residue.
5	44	63	614	Hypotonic; ptosis and pyloric spasm.
6	—	63	651	Hypotonic.
7	34	62	612	Slight ptosis with delayed evacuation.
8	19	61	637	Marked gastrocolop-tosis.
9	40	61	642	Gastroptosis.
10	43	60	672	Orthotonic; half residue; ? cause.
11	62	59	—	Ortho-hypotonic; ptosis; appendix stasis.
12	32	58	620	110 cubic centimetres left in stomach at two hours after commencement of test meal.
13	39	57	631	120 cubic centimetres left after commencement of test meal.
14	22	56	608	110 cubic centimetres left after commencement of test meal.
15	32	54	630	Marked gastro-colop-tosis (tuberculous salpingitis).
		70	604	Average of our own normal values under our own conditions of experiment.

Group IV., consisting of fourteen individuals, all convalescents from medical affections not gastric in nature. In this group the same tests were made as in Group III., but equilibration with alveolar air was made at 38° C.. No relationship between blood findings and gastric function was found.

Although we are convinced that blood chemistry and gastric function run parallel, there still remains the problem of showing that the former controls the latter. Our experiments are not yet concluded, but we have shown quite definitely that when a fall of plasma bicarbonate was produced in four healthy men by administering 10 grammes of ammonium



chloride in 2½% solution (Haldane<sup>(23)</sup>) on the night preceding the test meal, a fall in gastric tonus and total chloride of test meal resulted. On the other hand when five men raised their blood bicarbonate by rebreathing their own carbon dioxide through a 22-inch tube,<sup>(24)</sup> their acidity was raised by an average of 13° at one hour, though curiously enough the total chlorides at the same time were only slightly increased. We have since found that we did not allow sufficient time for rebreathing carbon dioxide to obtain decisive results. The rebreathing should have commenced about two or more hours before the meal commenced (Davies and others<sup>(24)</sup>), whereas in our experiments the time of rebreathing varied from nil to half an hour before the meal commenced.

We believe that these experiments (a) will lead to the explanation of much of the empirical methods of gastric treatment now in use and (b) will open out a large field for treatment in the future. Our own experience is too short to speak of as yet. Among the former might be mentioned the increased tonus that follows the repeated washing out of the stomach in atonic dyspepsia. Such a procedure by exciting the production of and removing hydrochloric acid from the body leads to an increase in blood bicarbonate, sometimes so severe as to lead to tetany, and improved gastric tone. Other procedures, probably leading to the same effect in this type of case, are the use of alkalis in spite of the hypochlorhydria, the use of a diet designed to stimulate hydrochloric acid production, the avoidance of fats and rest before and after meals.

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#### THE TONICS OF FOOD: SOME CLINICAL IMPRESSIONS.

By S. A. MOORE, M.D. (Edinburgh), M.R.C.P. (London),  
Dunedin.

THE late Sir James Mackenzie said that our knowledge of the ætiology of disease was for the most part a mere guess, while if we would make preventive medicine more than an attack on the fringe of the matter, we must learn to understand disease in its earliest stages, including the predisposing stage.<sup>(1)</sup> The study of the early stages of disease in the early part of this century led us, with our attention focussed on the living virus as a cause of disease, to recognize the time, mode and place of the primary infections which rendered the patient prone to the diseases for which he usually sought treatment.

Where no natural immunity exists against a disease, for example, syphilis, that disease may be regarded as newly introduced (biologically speaking) and the discovery of the virus gives the indication for prevention. But there are many common diseases, for example, gastric ulcer, appendicitis and dental caries, concerning which no question of a newly introduced living virus arises and in these diseases we may safely assume that it is not the seed, but the preparation of the soil which is important and that this preparation of the soil is due to errors in hygiene.

Modern work in diet comprises the study of the development of disease from its very beginning under the sole influence of deficiency in food tonic, one of the most important factors which render us prone to disease. It is therefore a main highway on which medical thought is travelling towards the attainment of those fundamental conceptions which will ultimately bring about the simplification and therefore mark the success of medicine.

Food, it is now recognized, consists not only of nutrients, protein, fat and carbohydrate, but also of tonics, minerals and vitamins, which, though small in amount, are a vital necessity. The flavour of food is an important characteristic, the study and practical utility of which is unfortunately being for the most part ignored by science. Food also contains roughage. Le Bon says that modern medicine is built upon a mystical belief in the power of the infinitely small. The demonstration of the power and importance of the tonics of food

strongly substantiates this belief and indeed is like the realization of a dream. However, the ignorance which continues to exist concerning these food tonics, is a peculiar companion to the great advance in our knowledge. Thus no vitamin has been isolated and we do not yet know the tissue changes and symptoms which are directly and solely due to deficiency or absence of any single vitamin. We are made to realize that probably other great deficiencies in our knowledge exist by the recent discovery of further vitamins *D* and *E* and in other ways.

That for every baby the mother loses a tooth was a common saying before the laboratory had demonstrated with exactness the increased demand for minerals and other tonics which maternity creates in the interest both of mother and child. We might have guessed it and some people did so.

Today many people feel justified in going further than the result of actual research in diet has led us and are prepared to accept the view that pending further information the only safe course is to define the optimum tonic diet as one from which all denatured food is excluded, which contains an abundance of the protective foods, milk and leafy vegetables which guard against the dangers of European diets, deficiency in fat-soluble *A* and in calcium, which does not contain an excess of muscle meat, but which includes viscera of animals, which provides as a last article of the meal a salivary stimulant, such as raw fruit.<sup>(2)</sup>

Modern diet is in error.

Not only has it been ascertained that many dietaries of people of western European civilization are dangerously low or actually deficient in certain food tonics, but puzzling epidemics have occurred in quite respectable countries which have ultimately proved to be deficiency diseases. Of special interest to New Zealand was the outbreak of a disease in Denmark caused by deficiency in fat-soluble *A*, due to exportation of much butter.

#### Minerals.

Confirmation of the deficiency in minerals in our diets is supplied by the endeavour of the manufacturing chemists to supply us with mineral tonics in organic combination as they occur in food and by the mass of mineral tonics prescribed by medical men and consumed by the populace to the satisfaction of all concerned, while these very patients are allowed to continue the consumption of food which has been to a large extent carefully demineralized. If we are to retain the respect and confidence of the community, this absurdity must be stopped.

#### Diet in New Zealand.

Inquiry as to the patient's diet in New Zealand not infrequently discloses gross errors in regard to food tonic; for example, the young man goes to the country and lives in the open air, but eating a diet of white bread and meat, breaks down. We meet the nervous patient who has restricted her diet to biscuits and tea. I have met one patient in whom I suspected a definite fat-soluble *A* de-

ficiency disease with central opacities in the cornea and a typical low form of pneumonia. She fed the rest of her household carefully, but was a gad-about and neglected her diet to go to the races, even when she could not see the horses.

Similar faulty diets to those described in other countries seem to obtain in New Zealand among considerable sections of the people.

#### Government Activity.

Although abundance of fresh food is produced in New Zealand, our methods of handling the food are becoming more and more those which are adapted for sending the food to London. It was until recently difficult to obtain butter that does not contain sodium benzoate; fresh food and leafy vegetables are scandalously dear if bought in the shop. The Government lends its aid to facilitate the export of food. Surely at the same time it should insist that those whom it helps in this manner, should take care to see that New Zealanders are supplied with really fresh samples of the food in which they trade. I am informed that in California the exportation of the best fruit is prohibited.

#### The Danger Zone.

The danger zone in tonic deficiency is that period during which the individual is not diseased, but is prone to contract either the deficiency disease in question or to contract diseases of quite different natures. The question arises: Are many of the cases of minor complaints met with in practice, such as dyspepsias, mild functional disturbances, really mild forms of deficiency diseases? Again the question arises: Are people inherently predisposed to such diseases as insanity, apoplexy and so on, rendered actually subject to them on account of some degree of deficiency in food tonic? Does the changing racial incidence of general paralysis of the insane, to mention one example, depend on variation in consumption of food tonic? That these questions cannot be answered by applying the therapeutic test of administering abundance of food tonics to the individual concerned is shown by laboratory experiment. Cramer<sup>(3)</sup> states that rats in a laboratory were fed on a diet chosen for economic reasons from market foods. The first individual rats showed no sign of deterioration, but in the fifth generation they had become puny with poor fur and lowered resistance to disease. The diet was relatively deficient in vitamins. Even when these puny rats were fed on a diet rich in tonic, they showed no difference in their lifetime from puny rats fed on the poor diet. In order to trace the development of the predisposing stage of disease in these rats, it is necessary to consider the diet of the great-great-grandparents and we could not settle the question of causation by the therapeutic test of administering abundant food tonic in one lifetime.

This experiment also modifies the rigid views we were taught as to the immutability of the germ plasm. The germ plasm is injured; as Eric Pritchard<sup>(4)</sup> pointed out, errors in food tonic must be considered as a possible source of amentia that

appears to arise spontaneously. We are also reminded that diet is of more importance in the prevention than in the cure of disease.

#### Alimentary Diseases.

Mackenzie<sup>(1)</sup> found that 25% of disease in the consulting room was disorder of the alimentary system, while that class of disease accounted for only 4% of deaths. This indicates that alimentary disorder weakens the system and renders the patient prone to contract other diseases. He adduces clinical evidence to support this view. One is reminded of the saying that we eat ourselves into our graves.

A relative deficiency in a vitamin not only causes the tissue change that is notoriously associated with it, but other widespread tissue changes occur which are even more important; for example in the case of vitamin B not only does the neuritis of beri-beri occur, but before that has developed there are definite changes in the mucosa of the alimentary system and in its functioning.

Alimentary toxæmia is thought by Lane and many others to be an important cause of disease. A relative deficiency<sup>(3)</sup> in vitamins causes intestinal flora to pass from the opening ducts of the intestinal glands where the presence of bacteria is said to be normal, to the deepest recesses of these glands.

This suggests a means by which alimentary toxæmia may arise and helps to explain the acknowledged failure of the intestinal antiseptics.

#### Results in Practice.

For some years in my practice I have freely used the optimum tonic diet as above defined. I do not claim that results prove anything, but I am left with a strong opinion that the use of this diet is not only a logical necessity, but also of distinct advantage in practice. It would seem to be reasonable in view of the evidence given above to use the optimum tonic diet in all derangements of the alimentary canal, for we may safely assume that the tonics of food are the best intestinal antiseptics and restoratives.

In many severe neuroses it is difficult or impossible to get patients to eat the optimum or any prescribed diet, but in any case diet often fails to cure their constipation, though that symptom yields completely to another form of treatment. The diet of some classes of nervous patients is often shocking from the point of view of food tonic and a consideration of food tonic in causation and in treatment is worth while.

Pregnant women are more comfortable on the optimum diet and men with piles have got on without operation in cases where operations seemed likely.

The common knock knee of New Zealand children may occur in a child fed from birth on optimum diet if the mother's diet has been faulty.

There is no difficulty in avoiding the use of denatured foods in gastric and duodenal ulcer from the outset of treatment. To use the optimum diet makes treatment less tedious and keeps the bowels

open. It gives one the impression that it produces better results.

Farmers treat diarrhoea in cows with bran and so I have treated for some time acute attacks of diarrhoea in my patients with kaolin and bran (in the form of proprietary breakfast bran foods) followed by vegetable *purées*, selected fruits, whole wheatmeal bread, fish and eggs. This treatment is less tedious and the gaseous distension that occurs when denatured foods follow castor oil, is avoided. In one case of severe diarrhoea of long duration with pyrexia the result was very good. In tuberculous diarrhoea this treatment has appeared to me useful.

In regard to constipation the same absurd position exists as in regard to mineral tonics. Patent pill vendors against whom we rail and manufacturing chemists make large profits out of purgative pills which are consumed by our corpulent and other constipated patients who continue the use under our care of a concentrated diet deprived in large measures of the natural tonics and roughage. Those who habitually live on the optimum diet, sometimes enter hospital and complain bitterly of the prolonged irregularities caused by the initial calomel and subsequent hospital diet of white bread and salts. Even in a dying patient with heart disease who had taken salts daily for years under medical direction, peanut butter and whole wheatmeal bread have caused the daily motion to be calm and comfortable instead of being like a confinement; similar results may be obtained in some persons with cerebral hæmorrhage.

The renal system has been shown to be extremely sensitive to lack of vitamins. Lack of vitamins permits albuminuria to occur.

In renal patients requiring starvation, diet should begin with vegetable waters of cooking, orange juice and the like and later milk. In treatment of renal patients a milk diet bores the patient to exasperation. The addition of vegetable and fruit vitamins gives flavour to the diet, corrects the constipation and appears to me to be better for the patient.

Glycosuria in infants and old men has disappeared on several occasions when the optimum diet was adopted and use of butcher meat was prohibited.

In middle age two patients with renal glycosuria have reaped benefit, for the optimum diet in these cases of whole wheatmeal bread, butter, peanut butter and honey was a staple combination of foods.

The most striking case I have to record, however, was that of a boy, aged eight years, whom I first saw in April, 1924. In earlier years he had suffered from acidosis which had been treated with rhubarb and soda with prompt success. At Christmas time, 1923, he had a mild chickenpox. In June, 1923, after three attacks of influenza he had bronchopneumonia, with fluid in the right pleural cavity. It was not tapped. For months before I saw him he had lost his usual brightness. His attendance at school in 1924 had been regular, but he had been "finicky" with his food, easily tired, sleepy, subject to colds and was bottom of his class. At times his

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eyes were puffy. While he had been *in utero* his mother had had attacks of diarrhoea and vomiting of some severity. His father suffered at times from asthma. A day's diet consisted of porridge, "Granose" biscuits or "Cornies" and milk, white bread and butter, bacon and eggs; meat, two vegetables, milk pudding and stewed fruit, raw apple; white bread, butter and jam and sometimes a boiled egg. At breakfast and at tea he drank a cup of milk and had an apple after school.

I prohibited butcher meat and put him on the optimum tonic diet. After the consumption of the honey was moderated, his glycosuria disappeared. In June, 1924, I was informed that he was well, free from glycosuria and top of his class. One day his apple had been cooked with sugar instead of honey and his face swelled round the eyes and he passed sugar. He has since eaten sugar in the form of chocolates without mishap. Since then the boy has remained well and is still at the top of his class. In October, 1926, his resting blood sugar was 0.06 and two hours after taking thirty grammes of glucose it was 0.006 and he passed no sugar.

There is no reasonable doubt in this case that the optimum tonic diet without meat produced an important change in this child's health.

The presumption is that he had had renal glycosuria for some months. The diet he had been on before treatment would be regarded by many practitioners as quite safe from a tonic point of view.

It is very curious that in Joslin's book on diabetes the word vitamin does not seem to be mentioned.

A change to the optimum diet may upset a patient just as a change of a diet in sheep from dry to green feed may upset them. The change should be made gradually if it does not seem at first to suit the individual.

#### Conclusion.

The fundamental mystical belief of medicine in the power of the infinitely small finds great support in the modern discoveries regarding food tonics. Not only does deficiency or absence of them cause crude diseases like beri-beri, scurvy and so forth and death, but modern work has shown that the epithelium of the alimentary, respiratory and renal systems are sensitive to relative deficiency of tonics. No ordinary drug has the same right to be regarded as Nature's remedy in the sense that food tonics may make this claim and no drug exhibits a more wonderful or more beneficial action.

It is logically correct to apply these findings in practice and to grope with these powerful agents where ignorance still reigns. We may provisionally regard the tonics of food as the best intestinal antiseptics and should consider dietetic error as a possible cause of disease like cancer.

We have as much right to develop a food tonic conscience as the surgeons have to develop an aseptic conscience.

To do this demands the exercise of a similar mental effort to that which the surgeons have

exerted in regard to asepsis. There are many practical difficulties in doing this. Diet like money, religion and sex, has deep roots in our mental life. To touch a man's diet in the ordinary way is like touching his pocket. The fear of death, however, enables us to influence both the pocket and the diet of our patients, but in so far as diet is concerned, much common practice is not only unscientific and harmful, but also is unnecessarily unpleasant. Patients are put on diets which are denatured, flavourless and constipating.

Dietetic rules for prevention of dental caries have been formulated in a certain town I know, but are not taught or practised in the hospitals or nursing homes there. Different schools there hold different opinions on this matter and yet they do not get together to carry out a research which would settle their differences. Surely if research is to be carried on in New Zealand, it might well be directed to settling this difference of opinion.

How can we expect the public to take diet discoveries seriously when we fail to apply them in our institutions and in our practice, although diet is a universal and fundamental thing in the prevention and treatment of disease.

If we are asked what is the best diet we must answer, the optimum tonic diet. I do not say that it is practical in all countries to overcome huge economic, social and neurotic forces which stand in the way of making such a diet that of the community, but in New Zealand many of our patients want to know what is the best and safest diet and we should answer them correctly. It may be true that departure from the optimum tonic diet can be safely made with certain precautions, but complexity of rules is to be avoided for patients and we may learn from the quack that the diet of people is most easily influenced if the method of religions, repeated simple dogmatic assertion is employed. Yet we must not exaggerate, but should adhere to the truth.

Recently I saw in an advertisement a statement credited to a prominent London surgeon that a loaf of whole wheatmeal bread contained as much nutriment as five white loaves. I suppose that not nutriment, but food tonic was meant. Perhaps if our leaders in dietetic thought were to make use of some popular word such as tonics to cover vitamins and minerals, the public would understand them more easily.

But further, if preventive medicine is to advance along the whole line, if incidentally quackery is to be reduced to a minimum, we as a profession must keep to the course laid down by Sir James Mackenzie. We must study the development of disease in its predisposing stage. To do this modern work and thought shows that we must study the preparation of the soil through the effects of single errors of hygiene. The Cinderellas of medicine in the past have been diet and psychology and it is obvious today that it is in these we shall find many secrets of our past failures in preventive medicine.

It is in the study of these that the highest hopes of the future lie.

I should like to see the next session of this Congress be a preventive medicine one in which simplification of medicine was the chief aim. This would mean that our chief subjects of discussion would be parts played by psychology, exercise and posture, dress, ventilation and last but not least diet in the preparation of the soil.

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#### DIET.

By T. RUSSELL RITCHIE, M.B., B.S. (New Zealand), D.P.H.,  
Samoa.

LIKE the Maori, the Samoan belongs to the Polynesian race, a race of very fine physique. In spite of the reputation for laziness which he has earned, chiefly because he will not work for the white man, unless circumstances render it necessary, the native does a considerable amount of hard work in connexion with ordinary village activities. A parade of the adult males of a village would show a higher standard of muscular development than would be found in the average New Zealander.

His food supply is ample, as Nature is bountiful, but at times tropical storms or very dry seasons cause temporary shortages of food.

The principal diet of the Samoan is vegetarian, with fish and on special occasions meat. Food deficiency diseases are unknown amongst them. Until a few years ago beri-beri was not uncommon amongst the Chinese indentured labourers on the plantations, due to the type of ration then on issue.

But although the Samoans have adequate plantations of foodstuffs, there is a tendency amongst them to vary their diet with imported foodstuffs, such as tinned and corned meats, polished rice, biscuits and white flour. Large quantities of these are imported yearly. It remains to be seen what effect, if any, such change in diet will have on the physique of the rising generation.

It is said that the Samoan physique is deteriorating. The cause lies probably less in dietetic causes than in the prevalence of hookworm. Since control of hookworm disease has occurred, there has been a distinct effect, for example, the birth rate has increased. There is certainly no ill health due to diet. The danger period for children is between six months and eighteen months, for at six months they are put on to an adult diet. One-third of total deaths occur during this period. Marasmus is very common between eight and nine months. In the Samoan child welfare scheme there is no humanized

milk used (only dried milk can be used with safety), but parents are being taught to use for their babies such things as the milk out of the cocoanut, arrow-root, oranges, pawpaw. The infant mortality has thus been reduced from 200 per thousand in 1924 to 120 per thousand in 1926.

#### DIET.

By ELIZABETH GUNN, M.B., B.S. (Edinburgh),  
Wanganui, New Zealand.

IN my district of Wanganui I have held since 1919 six health camps for children suffering from malnutrition, in all 550 children under my care in camp for four and a half to five and a half weeks.

Every child improved wonderfully in general health and in weight.

Good, plain, well-balanced, well-cooked meals, given at regular hours, plenty of sleep and rest is the order of the camp. The diet I give them should be within the reach of all New Zealand homes, often cheaper than their ordinary diet.

I give them "excessive calories," a diet with plenty of milk, butter, meat, vegetables. The increase in weight is astonishing. I do not wish you to think it is the story of the Strasburg goose. After the first few days they are all hungry for their meals.

These children come into camp food-faddy, nervous, irritable and easily upset. I consider that in children this unstable nervous condition can be controlled, if not cured by right methods of feeding.

Very little work is being done to attempt to control or cure the less spectacular disorders, such as indigestion, constipation and nervous debility, because they make very little impression on the general death rate, though they cause a vast amount of disablement, inefficiency and discontent and represent an appalling loss of work and waste of money.

Man is entirely dependent for his nervous energy, his happiness and his good temper on the state of his physical health and there is nothing health is so dependent upon as the quality of the food on which he nourishes his body.

Malnutrition from which all these children suffer, is not a disease of the poor more than of the rich. The rich are often fed on expensive, highly manufactured foods.

(To be continued.)

#### Corrigenda.

THE legend beneath Figure XI illustrating the article "The Morbid Anatomy of the Thyroid Gland in Hypothyroidism and Myxœdema" by Dr. A. H. Tebbutt, Dr. V. R. Woodhill and Dr. F. S. Hansman is incorrect (*Supplement to THE MEDICAL JOURNAL OF AUSTRALIA*, August 20, 1927, page 54). The picture is that of a normal thyroid gland for comparison with the pathological changes seen in the preceding pictures. The list of references has been omitted from the end of the article. It will be appended to another article by Dr. Tebbutt and Dr. Woodhill on aberrant thyroid tissue and tumours of the thyroid gland.

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"BYNO" HYPOPHOSPHITES is a restorative and tonic of special value in faulty nutrition and in convalescence. It increases the appetite and aids assimilation.

"BYNO" HÆMOGLOBIN is a unique preparation containing 15 per cent. of freshly-prepared Hæmoglobin. It is the pre-eminent blood tonic, and has proved to be most valuable in the various anæmias and in the convalescence.

"BYNO" PHOSPHATES is an improved chemical food, particularly valuable for children. The taste of the iron and other salts is effectively disguised. "Byno" Phosphates has no constipating effect.

"BYNO" GLYCEROPHOSPHATES is a concentrated tonic food of great value in general debility, emaciation and nervous dyspepsia. It is an improved product, containing the Glycerophosphates of Iron, Potassium, Calcium, Sodium and Magnesium in a stable solution.

"BYNO" LECITHIN is a valuable product containing in addition to Lecithin suitable proportions of the alkaloids of cinchona and nux vomica. It has proved to be a tonic and restorative of special value in cases of nervous debility and functional weakness generally.

Supplies of these products are obtainable at most Pharmacies.

*A Booklet giving full particulars of the "Byno" tonics will gladly be sent to any Medical Practitioner on request.*

## ALLEN & HANBURY'S (AUSTRALASIA) LTD.

13, Market Street, Sydney.



# Amytal

## A New and Better Hypnotic

DEVELOPED IN THE LILLY RESEARCH LABORATORIES



### Advantages

Small dosage  
Rapidity of action  
No undesirable after effects  
Produces natural sleep  
Patient awakens rested

### Indications

Insomnia  
Preoperative anxiety  
Nervousness  
Hyperthyroidism  
Menopausal symptoms

Amytal is supplied in one and one-half grain tablets in bottles of 40

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UNIFORM · PURE · STABLE

## The First Insulin Commercially Available

For over four years we have been making Insulin on a commercial scale. As a result of continuous research and experience in manufacturing large lots, we are offering an Insulin that is pure, stable and constant in unitage within very narrow limits.

Insulin, Lilly, may be relied upon to give uniformly satisfactory results. Supplied through the drug trade.

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